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ABSTRACT

The general purpose of the occupational analysis is to provide workable, basic information dealing with the many and varied duties performed in the machine trades occupation. The document opens with a brief introduction followed by a job description. The bulk of the document is presented in table form. Fifteen duties are broken down into a number of tasks and for each task a two-page table is presented, showing on the first page: tools, equipment, materials, objects acted upon; performance knowledge (related also to decisions, cues and errors); safety--hazard; and on the second page: science; math--number systems; and communications (performance modes, examples, and skills and concepts). The duties include: maintaining machinery; performing bench operations, precision and semi-precision measurements, and heat treating operations; operating pedestal grinder; and setting up and operating cut off saws, drill presses, lathes, shapers and slotters, vertical and horizontal milling machines, surface grinder, universal grinder, tool and cutter grinder, arbor press, and electrical discharge machine. (BP)

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Occupational Analysis

CE004 184

# MACHINE TRADES

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Instructional Materials Laboratory
Trade and Industrial Education
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5197

# AN ANALYSIS OF THE MACHINE TRADES OCCUPATION

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# FOREWORD

The occupational analysis project was conducted by The Instructional Materials Laboratory, Trade and Industrial Education, The Ohio State University in conjunction with the State Department of Education, Division of Vocational Education pursuant to a grant from the U.S. Office of Education.

The Occupational Analysis project was proposed and conducted to train vocational educators in the techniques of making a comprehensive occupational analysis. Instructors were selected from Agriculture, Business, Distributive, Home Economics and Trade and Industrial Education to gain experience in developing analysis documents for sixty-one different occupations. Representatives from Business, Industry, Medicine, and Education were involved with the vocational instructors in conducting the analysis process.

The project was conducted in three phases. Phase one involved the planning and development of the project strategies. The analysis process was based on sound principles of learning and behavior. Phase two was the identification, selection and orientation of all participants. The training and workshop sessions constituted the third phase. Two-week workshops were held during which teams of vocational instructors conducted an analysis of the occupations in which they had employment experience. The instructors were assisted by both occupational consultants and subject matter specialists.

The project resulted in producing one hundred two trained vocational instructors capable of conducting and assisting in a comprehensive analysis of various occupations. Occupational analysis data were generated for sixty-one occupations. The analysis included a statement of the various tasks performed in each occupation. For each task the following items were identified: tools and equipment; procedural knowledge; safety knowledge; concepts and skills of mathematics, science and communication needed for successful performance in the occupation. The analysis data provided a basis for generating instructional materials, course outlines, student performance objectives, criterion measures as well as identifying specific supporting skills and knowledge in the academic subject areas.

## Preface

In the last few years outstanding advances have been made in the machine trades area. The technical knowledge and new machining processes have been a boom to the modern day machine shop. With all the advances made some basic skills exist that existed many years ago. In this occupational analysis the participants have analyzed many of the basic tasks important for a beginning machinist to perform.

This occupational analysis was drawn up to provide a list of the duties, tasks, science, math, and technical knowledge of the tools and equipment used in the machinists' trade.

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## Job Description

A machinist works with metals and metal removal to form parts of a predetermined size and shape as indicated by a blueprint or shop sketch. This is accomplished through the proper setup and use of precision measuring tools, lathes, drills, milling machines, grinders, metal cutting saws, shapers, heat treating equipment, hand tools and other specialized machinery found in today's machine shops.

In all duties and operations, accuracy, proper tools usage, and safety are practiced. Blueprint reading, sequence of operation, and applied math are necessary skills to a successful machinist.

Duty A Maintaining Machinery

1 Diagnose trouble in malfunctioning machine
2 Disassemble defective section of machine
3 Repair defective parts of machine
4 Replace parts in machine
5 Test machine for performance after repair

(TASK STATEMENT) DIAGNOSE TROUBLE IN MALFUNCTIONING MACHINE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| All equipment and machinery listed under duties<br>Tachometer<br>Volt-ampmeter<br>Operator's manual<br>Machine parts listed<br>Assembly drawings | Sub-tasks<br><br>Determine malfunctioning area<br>Isolate defective part<br>Determine corrective procedures | Shut off power<br>Electrical shock<br>Avoid open gear trains<br>Cuts and bruises<br>Test electrical circuits correctly<br>Damaged equipment<br>Electric shock |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine whether to repair or replace defective part | Extent of damage to part<br>Cost of replacement | Improper use of test equipment |

(TASK STATEMENT) DIAGNOSE TROUBLE IN MALFUNCTIONING MACHINE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Effects of friction on work processes and product quality [Recognize effect of friction on parts]<br>Transfer of heat from one body to another [Recognize heat source]<br>Composition of matter, including protons, neutrons, atoms, electrons, molecules, elements<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Metal fatigue]<br>Effect of heating and cooling on expansion of materials<br>Fluids under pressure [Understanding hydraulics]<br>Inertia and momentum [Of machine]<br>Motion resulting from two or more forces acting on a point in a body [Recognize the effects of forces]<br>Relationship of force to distortion in an elastic body<br>Resistance of materials to change in shape<br>Centrifugal forces developed by bodies in rotation<br>Resistance of materials to flow of electrical current [Recognize short circuits] | Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits. (Measuring other than linear, square, and cubic) [Ampmeter]<br>Measure of time and speed (example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Recommendation report | Inductive reasoning, trade terminology, clarity of expression, and appropriate diction |
| Reading | Operation manuals | Detail and inference, comprehension, logic, description of mechanism, definition, and instructions |

(TASK STATEMENT) DISASSEMBLE DEFECTIVE SECTION OF MACHINE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| All equipment and machinery listed under duties<br><br>Wrenches<br>Parts lists<br>Assembly drawings<br>Drop cord<br>Gear puller | Turn off power<br>Refer to assembly drawing<br>Select tools for disassembly<br>Remove defective part | Correct use of wrenches<br>Damage to wrenches<br>Cuts or bruises<br>Turn power off<br>Electrical shock<br>Getting caught in moving parts |
| **DECISIONS** | **CUES** | **ERRORS** |
| Select proper tools for disassembly | Area of machine being disassembled | Failure to shut off power<br>Incorrect disassembly procedures |

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(TASK STATEMENT) DISASSEMBLE DEFECTIVE SECTION OF MACHINE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple hand tools]<br>Relationship of force to distortion in an elastic body<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Recognize strength of components]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Beneficial use of heat and cold for removal] | Measure with the Metric and English system and convert between them<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Determine wrench size] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operation manuals | Comprehension, trade terminology, detail inference, description of mechanism, definition, instructions |

(TASK STATEMENT) REPAIR DEFECTIVE PARTS OF MACHINE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| All equipment and machinery listed under duties<br><br>Wrenches<br>Assembly drawings<br>Parts list<br>Safety glasses | Identify proper size of part<br>Identify proper fit of part<br>Identify proper usage of precision measuring tools<br>Identify proper repair procedures | Safe operation of equipment<br>Cuts and abrasions<br>Eye injury<br>Burns |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine when and how to repair defective parts | Type of defects<br>Methods of repairing defects | Incorrect repair procedures |

(TASK STATEMENT) REPAIR DEFECTIVE PARTS OF MACHINE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Simple handtools]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Material required]<br>Effect of heating and cooling on expansion of materials<br>[Welding]<br>Fluids under pressure<br>[Beneficial use of hydraulic pressure]<br>Relationship of force to distortion in an elastic body<br>[Polishing or surface condition]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Beneficial use of heat for straightening] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Identify part numbers from parts list]<br>Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operations manuals | Comprehension, detail inference, description of mechanism, definition, instructions |
| Speaking | Instructions | Appropriate diction, trade terminology, clarity of expression, enunciation |

(TASK STATEMENT) REPLACE PARTS IN MACHINE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| All machinery and equipment listed under duties<br><br>Assembly drawings<br>Parts list | Be sure power is off<br>Refer to assembly drawing<br>Select tools for assembly<br>Remove old parts<br>Install new parts | Proper use of hand tools<br>Machine damage<br>Cuts and abrasions<br>Power not turned off<br>Electrical shock<br>Cuts, bruises, and fractures |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine correct assembly procedures<br>Select tools for assembly | Operations manual<br>Assembly procedure | Incorrect assembly procedure<br>Damage of new part during assembly |

(TASK STATEMENT) REPLACE PARTS IN MACHINE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Simple hand tools]<br>Effect of heating and cooling on expansion of materials<br>[Shrink fits or welding]<br>Fluids under pressure<br>[Hydraulic pressure (Pascals Law)]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Recognize strength of parts] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Identify parts number]<br>Measure with the Metric and English system and convert between them<br>Liquid and dry measures<br>[Replace lubricant in gear box] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operations manual | Comprehension, trade terminology, detail inference, description of mechanism, definition, and instructions |

(TASK STATEMENT) TEST MACHINE FOR PERFORMANCE AFTER REPAIR

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| All equipment and machinery listed under duties<br><br>Operators manual<br>Tachometer<br>Wrenches<br>Volt-ampmeter | Turn on power<br>Visually inspect machine<br>Start machine<br>Operate machine<br>Inspect machine for accuracy | All guards in place<br>Getting caught in gears or pulleys |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine test equipment to be used<br>Determine if machine is operating properly | Type of machinery repaired<br>Readings from test equipment | Improper use of test equipment |

(TASK STATEMENT) TEST MACHINE FOR PERFORMANCE AFTER REPAIR

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Adjustments]<br>Magnetic fields of force<br>[Electronic gauges] | Measure of time and speed<br>[R.P.M. speed]<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)<br>[R.P.M. gauge]<br>[Ampmeter] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operator's manual<br>Physical Experimentation Report | Comprehension, inductive reasoning, detail and inference, logic |
| Viewing | Inspect machine<br>Reading from test equipment | Visual analysis, describing, logic, detail inference, recognition of symbols, codes, emblems |

Duty B Performing Bench Operations

1 Deburr a workpiece
2 Layout workpiece
3 File piece to a dimension
4 Drill hole with hand drill motor
5 Hand tap a hole
6 Cut a thread with a hand die

(TASK STATEMENT) DEBURR A WORKPIECE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>File<br>Soft jaws<br>Vise<br>File card<br>Emery cloth<br>Power deburring equipment<br>Blueprint | Select deburring procedures and equipment<br>Deburr part | Avoid sharp edges<br>Cuts<br>Place handle on file<br>Cuts<br>Avoid file breakage<br>Cuts or eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select correct deburring procedure and equipment | Part to be deburred | Damage part with deburring equipment |

(TASK STATEMENT) DEBURR A WORKPIECE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Simple hand tools]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Hardness of material]<br>Effects of friction on work processes and product quality<br>[Filing] | Measure of length and angles |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, trade terminology, detail inference, recognition of symbols, codes, emblems |
| Viewing | Part | Visual analysis, describing, logic, detail inference |
| Touching | Surface | Size, shape, and texture |

(TASK STATEMENT) LAYOUT WORKPIECE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Center head<br>Combination square<br>Bevel head<br>Scale<br>Scribe<br>Prick punch<br>Hammer<br>Blueprint<br>Dividers<br>Layout dye<br>Safety glasses<br>Vernier height gauge<br>Center punch | Consult blueprint<br>Apply layout dye<br>Scribe and layout part<br>Check layout<br>Centerpunch as needed | Safe use of scribe and dividers<br>Puncture wounds<br>Safe use of hammer<br>Bruises and eye injury<br>Appropriate eye protection<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Select proper layout procedure | Blueprint | Failure to maintain necessary accuracy |

(TASK STATEMENT) LAYOUT WORKPIECE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Use of layout tools]<br>Differences in absorption and radiation of energy between dark rough surfaces and light, smooth, polished surfaces.<br>[Absoption when applying layout dye]<br>Effects of friction on work processes and product quality<br>[Scratching workpiece with scribe]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Resistance and strength of material] | Basic arithmetic skills<br><br>Measures of length<br>Measure with the Metric and English system and convert between them<br>[Read angular dimensions]<br>[Knowledge of metric dimensions]<br>Understanding and use of the Pythagorean theorem, based on the right triangle<br>Geometric constructions<br>Use of trigonometric functions in solution of problems involving right triangles |

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COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, trade terminology, detail inference, recognition of symbols, codes, emblems |
| Viewing | Layout | Visual analysis, describing, logic, detail inference |

(TASK STATEMENT) FILE PIECE TO A DIMENSION

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>File<br>File card<br>Blueprint<br>Measuring tools<br>Soft jaws<br>Vise<br>Micrometer | Select file<br>Clamp piece in place<br>File workpiece<br>Inspect part dimensions | Handle in place on file<br>Puncture wound<br>Avoid breaking file<br>Cuts and eye injuries<br>Avoid sharp edges on parts<br>Cuts |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine correct workholding methods<br>Determine correct file selection | Size and shape of workpiece, blueprint | Incorrect selection and use of file<br>Damage to part in clamping<br>Excessive metal removal |

(TASK STATEMENT) FILE PIECE TO A DIMENSION

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple hand tools]<br>Effects of friction on work processes and product quality<br>[Filing]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Hardness of workpiece] | Measures of length<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Blueprint dimensions correctly interpreted]<br>Measure with the Metric and English system and convert between them<br>Given an instrument of measure, determine precision, and/cr accuracy with respect to relative error, tolerance and significant digits<br>(Measuring and other than linear, square, and cubic)<br>[Micrometer]<br>Basic arithmetic skills |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, trade terminology, detail inference, recognition of symbols, codes, and emblems |
| Viewing | Part dimensions | Visual analysis, describing, and logic |
| Touching | Surface of part | Size, shape, and texture |

(TASK STATEMENT) DRILL HOLE WITH HAND DRILL MOTOR

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Drill motor<br>Drill<br>Drill chuck key<br>Vise<br>Soft jaws<br>Safety glasses<br>Clamps<br>Wrenches<br>Coolant<br>Blueprint<br>Countersink | Select proper drills<br>Clamp workpiece<br>Apply coolant<br>Drill<br>Deburr<br>Inspect | Drill motor properly grounded<br>Electrical shock<br>Piece clamped properly to prevent movement<br>Cuts and bruises<br>Drill sharpened properly for material to be drilled<br>Cuts and eye injury<br>Broken drill<br>Hot shavings and chips<br>Cuts and bruises |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select holding method | Size and shape of workpiece<br>Blueprint | Incorrect drill size<br>Improper clamping of workpiece<br>Improperly sharpened drill<br>Failure to use coolant |

(TASK STATEMENT) DRILL HOLE WITH HAND DRILL MOTOR

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines [Using simple hand tools]<br>Effect of heating and cooling on expansion of materials<br>Effect of heating and cooling on state of matter (Change of matter from one form to another) [Heat change shape or dimension of workpiece]<br>Centrifugal forces developed by bodies in rotation<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another [Transfer of mechanical energy to heat]<br>Effects of friction on work processes and product quality [Effects of friction]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape [Strength of materials] | Measures of length [Metric]<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Fractional, letter, and number drill sizes]<br>Read and interpret charts, tables, and/or graphs [Use of tap drill chart]<br>Locate by approximation rational numbers and integers on the number line (sequential ordering) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, trade terminology, detail inference, recognition of symbols, codes, and emblems |
| Viewing | Inspect workpiece | Visual analysis, describing, logic, detail inference |
| Touching | Surface of workpiece | Size, shape, texture, and temperature |

(TASK STATEMENT) HAND TAP A HOLE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Tap<br>Tap wrench<br>Work holding device<br>Lubricant for tap (cutting oil)<br>Safety glasses<br>Blueprint | Select tap and wrench<br>Lubricate tap<br>Tap hole<br>Clean and inspect | Tap breakage<br>Eye injury<br>Sharp edges (burrs) on tapped hole<br>Cuts |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine tap selection | Thread size, hole diameter | Failure to reverse tap to break chip<br>Tapping with a dull tap<br>Lack of lubricant<br>Starting tap crooked |

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(TASK STATEMENT) HAND TAP A HOLE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using hand tools]<br>Effect of heating and cooling on expansion of materials<br>[Effects of heat]<br>Transfer of energy from one form to another<br>[Transfer of mechanical energy to heat]<br>Effects of friction on work processes and product quality<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Strength of materials (tap breakage)] | Basic arithmetic skills<br>Read and interpret charts, tables, and/or graphs<br>[Read and interpret tap drill chart]<br>Manipulation of formula involving three factors<br>[Formula for tap drill sizes] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems |
| Viewing | Inspect workpiece | Visual analysis, describing, logic, detail inference |
| Touching | Surface of workpiece | Size, shape, and texture |

(TASK STATEMENT) CUT A THREAD WITH A HAND DIE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Button die<br>Die holder<br>Cutting oil<br>Vise<br>Tap drill chart<br>Clamps<br>Wrenches<br>Safety glasses | Clamp work in vise<br>Select proper die and die stock<br>Lubricate<br>Cut thread<br>Clean and inspect | Do not use power equipment to cut with hand dies<br>Ruin piecework<br>Break die<br>Sharp edges on threads<br>Cuts |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine type of die to use (Standard, pipe, or metric) | Thread size | Starting die crooked<br>Failure to reverse die to break chip<br>Thread with a dull die<br>Lack of lubricant |

(TASK STATEMENT) CUT A THREAD WITH A HAND DIE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using hand tools]<br>Effect of heating and cooling on expansion of materials<br>[Effects of heat]<br>Transfer of energy from one form to another<br>[Transfer of mechanical energy to heat]<br>Effects of friction on work processes and product quality<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Strength of materials (die breakage)] | Read and interpret charts, tables, and/or graphs<br>[Read tap drill and thread chart]<br>Measure with the Metric and English system and convert between them |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Tap drill and thread chart | Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems |
| Viewing | Inspect workpiece | Visual analysis, describing, logic, detail inference |
| Touching | Surface of workpiece | Size, shape, and texture |

Duty C Performing Precision and Semi Precision Measurements

1 Measure with a steel rule
2 Measure with calipers
3 Measure angle with protractor
4 Check radius with radius gauge
5 Check work with a thickness gauge
6 Measure with a combination set
7 Measure with micrometers
8 Measure with vernier height gauge
9 Measure with vernier calipers
10 Check hole with a hole gauge
11 Check work with a dial indicator
12 Check work with plug and ring gages
13 Measure angles with sine bar
14 Calibrate micrometers

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(TASK STATEMENT) MEASURE WITH STEEL RULE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Steel rules<br>Hook rules<br>Depth rules<br>Short length rules<br>Tape rules<br>Slide caliper rules<br>Metric rules | Select proper rule as to calibration and graduation<br>Read rule accurately | Shut off machinery<br>Cuts and bruises |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine rule graduations and calibration to use<br>Determine when to use English or Metric rule | Relative length of piecework | Failure to accurately read rule |

(TASK STATEMENT) MEASURE WITH STEEL RULE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>[Measuring tool] | Measures of length<br>[English measuring system]<br>Measure with the Metric and English system and convert between them<br>[Metric measuring system]<br>Basic arithmetic skills |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Rule | Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems |

37

(TASK STATEMENT) MEASURE WITH CALIPERS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Inside caliper<br>Outside caliper<br>Hermaphrodite calipers<br>Steel rule<br>Micrometers<br>Vernier calipers | Select calipers needed for degree of accuracy required<br>Adjust calipers to correct fit<br>Measure caliper setting with rule or micrometers | Sharp point on hermaphrodite caliper<br>Puncture wounds |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy required<br>Determine when the feel or drag is correct | Relative precision of workpiece<br>Tension on caliper opening | Incorrect "feel" of calipers when measuring |

38

(TASK STATEMENT) MEASURE WITH CALIPERS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage [Measuring tool]<br>Work input, work output, friction and efficiency in simple machines [Effects of friction with simple tools] | Measures of length<br>Measure with the Metric and English system and convert between them<br>Basic arithmetic skills |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Calipers | Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems |
| Touching | Calipers | Size, movement, and tension |

(TASK STATEMENT) MEASURE ANGLES WITH PROTRACTOR

46

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Protractor head and steel blade<br>Bevel protractor<br>Vernier bevel protractor<br>Surface plate | Select protractor needed for degree of accuracy required<br>Set protractor to the corresponding angles<br>Record reading | Shut off machinery<br>Cuts or abrasions from moving parts |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine degree of accuracy required<br>Determine correctness of fit of workpiece | Shape and surface condition of workpiece<br>Precision of finished works | Moving of the protractor blade when reading |

40

(TASK STATEMENT) MEASURE ANGLES WITH PROTRACTOR

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage (measuring tool) | Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic)<br><br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Degrees and minutes]<br><br>Addition and subtraction of whole numbers |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Protractor | Visual analysis, logic, and recognition of symbols, codes, and emblems |
| Writing | Record readings | Penmanship, classification, and trade terminology |

(TASK STATEMENT) CHECK RADIUS WITH RADIUS GAGE

42

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Radius gage and handle | Select proper radius gage<br>Check radius by holding workpiece up to the light and checking with gage | Shut off machinery<br>Cuts or abrasions |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine accuracy of reading needed | Workpiece is not clean or free from burrs | Improper measurement or reading |

42

(TASK STATEMENT) CHECK RADIUS WITH RADIUS GAGE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| | Basic arithmetic skills<br><br>Measure with the Metric and English system and convert between them<br>[Changing fractions to decimals and decimals to fractions]<br>Congruence (checking radius) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Compare workpiece to gage | Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems |
| Touching | Workpiece | Size, shape, and texture |

(TASK STATEMENT) CHECK WORK WITH THICKNESS GAGE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Thickness gage<br>Clamps<br>Wrenches<br>Surface plate | Select proper blade thickness<br>Check with thickness blade | Shut off machinery<br>Cuts or abrasions |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine when "feel or drag" is correct | Nature of piece to be measured | Incorrect measure |

(TASK STATEMENT) CHECK WORK WITH THICKNESS GAGE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Work input, work output, friction and efficiency in simple machines<br>[Effects of friction with hand tools] | Basic arithmetic skills<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic)<br>[Thickness gage] |

AS

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Compare workpiece to gage | Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems |
| Touching | Gage | Size, tension |



AS

(TASK STATEMENT) MEASURE WITH A COMBINATION SET

46

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Square head<br>Level<br>Scriber<br>Center head<br>Protractor head<br>Steel blade | Select measuring device needed<br>Mount proper device on the blade<br>Position and fit set in place<br>Read measure indicated | Sharp end on scriber<br>Puncture wound |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine type of measuring to be done<br>Select proper combination of set parts for shape of workpiece | Surface condition of workpiece<br>Shape to be measured | Measuring device not tight on blade<br>Improper fit on piecework |

46

(TASK STATEMENT) MEASURE WITH A COMBINATION SET

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple hand tools] | Read degree measurement<br>Measures of length<br>Geometric constructions (Perpendiculars to line, bisecting angles, finding the center of an arc, etc.)<br>[Determination of perpendicularity] |

47

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Read measures<br>Shape of workpiece | Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Fit of measuring | Size, shape, texture, tension, movement |



47

(TASK STATEMENT) MEASURE WITH MICROMETER

48

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Outside micrometer<br>Vernier micrometer<br>Thread micrometer<br>Inside micrometer<br>Depth micrometer<br>Metric micrometer | Select micromter needed<br>Check micrometer for accuracy<br>Measure workpiece | Stop machinery before measurement<br>Cuts<br>Care when using micrometer<br>Loss of accuracy |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine type of micrometer to use<br>Determine the proper feel of the micrometer when measuring<br>Determine if workpiece is too hot to measure accurately | Workpiece is not clean or free from burrs<br>Temperature of workpiece when measuring | Improper measure<br>Damage micrometer |

48

(TASK STATEMENT) MEASURE WITH MICROMETER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple hand tools]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Strength of materials (overtightening)] | Measures of length<br>[Decimals-English system]<br>Measure with the Metric and English system and convert between them<br>**[Millimeter-Metric system]**<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)<br>[Micrometer]<br>[Changing fractions to decimals]<br>Basic arithmetic skills |

A9

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Read measures<br>Shape of workpiece | Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Fit of measuring | Size, shape, texture, tension, movement, temperature |

A9

(TASK STATEMENT)

MEASURE WITH VERNIER HEIGHT GAGE

50

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Vernier height gage<br>Scriber point<br>Dial indicator<br>Gage blocks<br>Layout dye<br>Magnifying glass<br>Thickness gage<br>Surface plates | Clean surface plate<br>Set height gage<br>Check or scribe workpiece | Sharp scriber point<br>Puncture wound or cuts |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy required<br>Determine proper feel when measuring | Dirt or grit on the surface plate<br>Shape of workpiece to be measured | Improper measure<br>Damaged gage |

(TASK STATEMENT) MEASURE WITH VERNIER HEIGHT CAGE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple hand tools]<br>[Properties of light and focal length (magnifying glass] | Measures of length<br>[Decimals]<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)<br>Measure with the Metric and English system and convert between them<br>Basic arithmetic skills<br>[Changing fractions to decimals] |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Read measures<br>Shape of workpiece | Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Fit of measuring | Size, shape, texture, tension, movement |

(TASK STATEMENT) MEASURE WITH VERNIER CALIPERS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Vernier calipers<br>Magnifying glass<br>Vernier gear tooth calipers | Adjust calipers to proper "feel"<br>Read vernier scale | Shut off machine<br>Cuts and bruises<br>Damage to calipers |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine proper adjustment when measuring | Workpiece clean or free from burrs<br>Shape of workpiece to be measured | Improper measure |

(TASK STATEMENT) MEASURE WITH VERNIER CALIPERS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple hand tools]<br>Properties of light and focal length (magnifying glass) | Measures of length<br>[Decimals]<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)<br>[Calipers]<br>Measure with the Metric and English system and convert between them<br>Basic arithmetic skills<br>[Changing fractions to decimals] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Read measures<br>Shape of workpiece | Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Fit of meauring | Size, shape, texture, tension, movement |

(TASK STATEMENT) CHECK HOLE DIAMETER WITH HOLE GAGE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Small hole gage<br>Telescoping gage<br>Vernier calipers<br>Inside micrometers<br>Inside calipers<br>Outside micrometers<br>Dial bore gage | Select proper measuring device<br>Set measuring device to fit hole<br>Check measuring device with micrometer | Shut off machinery<br>Cuts |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy required<br>Determine proper feel when measuring<br>Determine proper temperature for accurate measure | Workpiece clean or free from burrs<br>Temperature of workpiece | Incorrect measure |

(TASK STATEMENT) CHECK HOLE DIAMETER WITH HOLE GAGE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work inout, work output, friction and efficiency in simple machines<br>[Using simple hand tools] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic)<br>[Micrometer]<br>Measure with the Metric and English system, and convert between them<br>Basic arithmetic skills<br>[Changing fractions to decimals] |

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COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Read measures<br>Shape of workpiece | Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Fit of measuring device | Size, shape, texture, tension, movement, temperature |



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(TASK STATEMENT) CHECK WORK WITH A DIAL INDICATOR



| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Dial indicator<br>Indicator holder<br>Surface plate<br>Clamps<br>Wrenches<br><br>Any piece of machinery where an indicator can be used | Clean work surface<br>Select dial indicator needed<br>Mount indicator on holding device<br>Record reading of the dial | Care when using indicator<br>Loss of accuracy<br>Shut off machinery<br>Cuts and abrasions |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine type of indicator to use<br>Determine indicator holding device needed | Mount indicator securely<br>Dirt or grit on work surface | Incorrect reading |

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(TASK STATEMENT) CHECK WORK WITH A DIAL INDICATOR

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple tools] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)<br>Measure with the Metric and English system and convert between them<br>Basic arithmetic skills |

LS

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Read indicator<br>Size and shape of workpiece | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Surfaces | Size, shape, texture, movement |



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(TASK STATEMENT) CHECK WORK WITH PLUG AND RING GAGES

58

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Plug gage<br>Ring gage<br>Workpiece<br>Micrometers<br>Prussian blue | Select plug or ring gage needed<br>Apply prussian blue if checking tapers is required | Shut off machine<br>Cuts and abrasions |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine accuracy required<br>Determine the proper feel<br>Determine if workpiece is too hot to measure accurately | Workpiece clean or free from burrs<br>Temperature of workpiece | Incorrect measure |

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(TASK STATEMENT) CHECK WORK WITH PLUG AND RING GAGES

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple tools]<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements<br>Effects of friction on work processes and product quality<br>[Usage of Prussian blue] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic)<br>Measure with the Metric and English system and convert between them<br>Basic arithmetic skills |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Read measures<br>Shape of workpiece | Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Fit of measuring device | Size, shape, texture, tension, movement, temperature |

(TASK STATEMENT) MEASURE ANGLES WITH A SINE BAR



| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Two blocks<br>Sine bar<br>Vernier height gage<br>Dial indicator<br>Surface plate<br>Magnifying glass<br>Trigonometry table | Clean surface plate<br>Select proper height of blocks<br>Mount work on sine bar<br>Mount indicator on holding device<br>Measure angle | |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy required | Dirt or grit on surface plate | Incorrect calculation of sine |

(TASK STATEMENT) MEASURE ANGLES WITH A SINE BAR

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple tools]<br>Properties of light and focal length (Magnifying glass) | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic)<br>Measure with the Metric and English system and convert between them<br>Basic arithmetic skills<br>Use of trigonometric functions in solution of problems involving right triangles |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Trigonometry | Table, comprehension, detail inference, trade terminology |
| Viewing | Sine bar | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Surface plate<br>Mount | Texture, movement |

(TASK STATEMENT)

CALIBRATE MICROMETER



| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Micrometer<br>Micrometer wrenches<br>Standards | **Clean standards**<br>Determine how to adjust micrometer<br>Check micrometer for accuracy<br>Set micrometer | Care when using micrometers<br>Loss of accuracy |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine proper feel of micrometer | Tension of micrometer | Dirt on standard or micrometer<br>Incorrect measure |

(TASK STATEMENT) CALIBRATE MICROMETERS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple tools]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Effects of heating and cooling] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Micrometer]<br>Measure with the Metric and English system and convert between them<br>Basic arithmetic skills<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Standards, blocks] |

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COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Micrometer readings | Comprehension, trade terminology, visual analysis, logic, detail inference, recognition of codes, symbols, and emblems |
| Touching | Fit of micrometer | Size, shape, and texture |

63

Duty D **Setting Up and Operating Metal Cutting Saws**

1 Interpret blueprint language
2 Clean and lubricate saws
3 **Install and adjust saw guides**
4 Select and weld band saw blades
5 Install blade and adjust tension
6 Set and operate saw controls
7 Select and cut material with saw
8 Remove and inspect part of saw

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(TASK STATEMENT) INTERPRET BLUFPRINT LANGUAGE



| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Blueprint | Select appropriate print by code number<br>Identify and interpret symbols and schematics<br>Interpret locations and dimensions<br>Interpret sizes, shapes, and finishes<br>Transfer measures from blueprint to workpiece | |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine measurement transfer, layout procedure to maintain accuracy of tolerances | Degree of accuracy indicated on drawings | Misinterpretation of blueprint dimensions |

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(TASK STATEMENT) INTERPRET BLUEPRINT LANGUAGE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| | Determination of area and circumference of circles<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Blueprint code]<br>Read and interpret charts, tables, and/or graphs<br>Measure with the Metric and English system and convert between them<br>Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic)<br>Basic arithmetic skills<br>Determination of area, perimeter and diagonals of quadrilaterals (4 sided figures)<br>Determination of area, perimeter and diagonals of polygons with more than 4 sides |

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| COMMUNICATIONS | | |
|---|---|---|
| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
| Reading | Comprehend blueprint | Comprehension, trade terminology, description of mechanism, clarity of expression, instruction (oral and informal), logic, recommendation report (oral and informal) |

(TASK STATEMENT) CLEAN AND LUBRICATE SAW

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Oil<br>Grease<br>Oil can<br>Grease gun<br>Rags<br>Solvent<br>Brushes<br>Measuring containers<br>Lubrication charts<br>Abrasive material<br>Wrenches<br>Drop cord | Clean fittings before lubrication<br>Remove and install plug and covers<br>Make necessary adjustments<br>Start and stop machinery | Avoid chips<br>Causes cuts<br><br>Do not use pressurized air<br>Eye and machine damage<br><br>Shut machine off before cleaning<br>Electrical shock<br><br>Avoid spills<br>Falls<br><br>Proper disposal of lubricants and solvents<br>Fire<br>Water pollution |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine proper frequency of lubrication<br>Select proper lubricant<br>Locate all lubrication points<br>Determine correct amount of lubricant | Operation manual guidelines<br>Type of machinery | Equipment malfunction |

(TASK STATEMENT) CLEAN AND LUBRICATE SAW

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements<br>[Properties of lubricants]<br>Effects of friction on work processes and product quality<br>[Friction causes deterioration] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Society of Automotive Engineers Specifications]<br>[American Iron and Steel Institute Specifications]<br>Read and interpret charts, tables, and/or graphs<br>[Lubrication charts]<br>Liquid and dry measures<br>[Liquid measure] |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operational manuals | Comprehension, trade terminology, description of mechanisms, definition instructions |
| Viewing | Equipment | Visual analysis, describing, logic, detailed inference, color discrimination |
| Touching | Equipment | Temperature, texture, movement, tension |

(TASK STATEMENT) INSTALL AND ADJUST SAW GUIDES



| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Gage<br>Wrenches<br>Thickness gage | Select saw guides<br>Clean saw guides and slot<br>Install guides<br>Adjust guide and check | |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine proper guide to use<br>Determine proper adjustment | Thickness of workpiece<br>Type of workpiece | Improper selection<br>Improper adjustment |

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**(TASK STATEMENT)** INSTALL AND ADJUST SAW GUIDES

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Simple hand tools] | Measures of length |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Saw guides | Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems |
| Touching | Adjustments | Movement |

(TASK STATEMENT) SELECT AND WELD BAND SAW BLADE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Band saw blade<br>Band saw welder<br>Pull out scale<br>File<br>Grinder<br>Thickness gage | Select blade<br>Cut to length<br>Prepare ends<br>Clamp in welder<br>Set control for welder<br>**Weld blade**<br>Check weld<br>Temper weld<br>File or grind excess weld<br>Fit blade to gage<br>Retemper weld | Welding<br>Flash or burns<br>Handling saw blade<br>Cuts<br>Grinding weld<br>Eye injury<br>Abrasions<br>Incorrect pitch blade for material<br>Broken saw blade<br>Cuts |
| **DECISIONS** | **CUES** | **ERRORS** |
| Select welder control setting<br>Determine tempering heat | Saw blade<br>Weld | Improper control setting<br>Improper tempering<br>Improper grinding of weld |

(TASK STATEMENT) SELECT AND WELD BAND SAW BLADE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Heat Treatment Metallurgy<br>Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Simple hand tools (levers)]<br>Effect of heating and cooling on state of matter (Change of matter from one form to another )<br>Transfer of energy from one body to another<br>[Electrical welder]<br>Resistance of materials to flow of electrical current<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[(Annealing) Strength of materials] | Measures of length [Linear measurement]<br>Measures of temperature<br>Given a coding sytem, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Color codes for temperature of tempering]<br>[Pitch selection system] |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Saw blade<br>Weld scales | Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems |
| Touching | Blade surface<br>Weld | Texture, temperature |

(TASK STATEMENT) INSTALL BLADE AND ADJUST TENSION

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Saw<br>Blade | Install blade on pulleys<br>Adjust tension<br>Check tension | Handling saw blade<br>Cuts<br>Blade reversed<br>Dull or broken blade |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select proper tension | Band tension gage | Blade reversed<br>Improper tension |

(TASK STATEMENT) INSTALL BLADE AND ADJUST TENSION

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using levers and pulleys] | |

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Blade set-up<br>Tension gage | Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems |
| Touching | Blade tension | Movement |

(TASK STATEMENT) SET AND OPERATE SAW CONTROLS



| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Saw<br>Speed chart | Start saw<br>Adjust speed control<br>Adjust feed control | Excessive speed of saw<br>Destroyed saw blade<br>Excessive feed of material<br>Broken blade<br>Cuts |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine speed and feed to be utilized | Speed chart<br>Formula<br>Composition of workpiece<br>Size of workpiece<br>Shape of workpiece | Poor cutting action<br>Dragging |

(TASK STATEMENT) SET AND OPERATE SAW CONTROLS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple hand tools]<br>Transfer of energy from one form to another<br>Motion resulting from two or more forces acting on a point in a body<br>[(Automatic feed) Transfer of energy] | Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.)<br>[RPM gage] |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Saw controls | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Controls | Tension, movement |

(TASK STATEMENT) SELECT AND CUT MATERIAL WITH SAW

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Bar stock<br>Saw<br>Saw blade<br>Pull out scale<br>Steel color code chart<br>Prick punch<br>Dividers<br>Hammer<br>Blueprint | Select material<br>Clamp material | Burrs on material<br>Cuts<br>Proper handling of heavy material<br>Bruises, cuts, or fractures |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select correct material<br>Select proper clamping procedure<br>Select feeds and speeds | Color code sheet<br>Blueprint<br>Formula<br>Composition, size, shape of workpiece | Poor cutting action<br>Dragging |

(TASK STATEMENT) SELECT AND CUT MATERIAL WITH SAW

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Using simple hand tools] [Levers]<br>Transfer of energy from one form to another<br>[Transfer mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Friction created by sawing]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Strength of materials] | Measures of length<br>[Linear measurement]<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Color codes for steel]<br>Measure with the Metric and English system and convert between them<br>[Knowledge of geometric shapes] |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint<br>Steel color<br>Code chart<br>Scale | Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems |
| Viewing | Material<br>Clamp set-up | Visual analysis, logic, detail inference |
| Touching | Clamp set-up | Tension and movement |

(TASK STATEMENT) REMOVE AND INSPECT PART OF SAW

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Pull out scale<br>Blueprint<br>Micrometers<br>Vernier calipers | Remove part from saw<br>Deburr part<br>Inspect part<br>Deburr excess material | Burrs on workpiece<br>Cuts<br>Avoid contact with saw blade<br>Cuts<br>Handle material properly<br>Bruises<br>Fractures |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy required | Micrometer<br>Scale<br>Blueprint | Dirt or grit on part<br>Burrs on part |

(TASK STATEMENT) REMOVE AND INSPECT PART OF SAW

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| | Measures of length |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint<br>Scale | Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems |
| Viewing | Micrometer<br>Calipers<br>Workpiece | Visual analysis, logic, detail inference |
| Touching | Workpiece<br>Micrometer | Size, shape, texture, tension, and movement |

Duty E Setting Up and Operating Drill Presses

1 Clean and lubricate drill press
2 Select and mount work and work holding device
3 Center drill and drill a hole on the drill press
4 Ream a drilled hole with a drill press
5 Tap hole using tapping attachment
6 Spotface a hole
7 Countersink a hole
8 Counterbore a hole
9 Set and operate drill press controls
10 Remove and inspect part from drill press

(TASK STATEMENT) CLEAN AND LUBRICATE DRILL PRESS

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Oil<br>Grease<br>Oil can<br>Grease gun<br>Rags<br>Solvent<br>Brushes<br>Measuring containers<br>Lubrication charts<br>Abrasive material<br>Drop cord<br>Wrenches | Clean fittings before lubrication<br>Remove and install plug and covers<br>Make necessary adjustments<br>Start and stop machinery | Avoid chips<br>Cuts<br>Do not use pressurized air<br>Eye and machine damage<br>Shut machine off before cleaning<br>Electrical shock<br>Avoid spills<br>Falls<br>Proper disposal of lubricants and solvents<br>Fire<br>Water pollution |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine proper frequency of lubrication<br>Select proper lubricant<br>Locate all lubricant parts<br>Determine correct amount of lubricant | Operation manual guidelines<br>Type of machinery | Equipment malfunction |

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(TASK STATEMENT) CLEAN AND LUBRICATE DRILL PRESS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements<br>[Properties of lubricants]<br>Effects of friction on work processes and product quality<br>[Friction causes deterioration] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Society of Automotive Engineers Specifications]<br>[American Iron and Steel Institute Specifications]<br>Read and interpret charts, tables, and/or graphs<br>[Lubrication charts]<br>Liquid and dry measures<br>[Liquid measure] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operational manuals | Comprehension, trade terminology, description of mechanism, definition, instructions |

(TASK STATEMENT)

SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Vee blocks<br>Clamps<br>Wrenches<br>Drill jig<br>Vise<br>Step blocks | Select proper work holding device<br>Clean table and work holding device<br>Mount work holding device on table<br>Mount work in work holding device | Holding device not tight<br>Cuts and abrasions<br>Work not clamped tightly<br>Cuts and abrasions |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine type of holding device<br>Determine how to mount holding device | Size and shape of workpiece | Dirty table<br>Work holding device not tight<br>Work improperly clamped |

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Clamps, T-bolds, jigs, and fixtures]<br>[Setting time]<br>Motion resulting from two or more forces acting on a point in a body<br>[Resistance to motion (torque)]<br>Relationship of force to distortion in an elastic body<br>Resistance of materials to change in shape<br>[Proper tightening torque] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Wrench sizes] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece Mounting | Visual analysis, detail inference, logic, describing |
| Touching | Workpiece Mounting | Size, shape, tension, and movement |

(TASK STATEMENT)

CENTER DRILL AND DRILL A HOLE ON THE DRILL PRESS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Drill press<br>Drill chuck<br>Chuck key<br>Sleeve<br>Drill<br>Center drill<br>Workpiece<br>Drift key<br>Ballpeen hammer<br>Safety glasses<br>Coolant<br>Blueprint | Select proper drills<br>Clamp workpiece<br>Apply coolant<br>Center drill<br>Drill<br>Deburr<br>Inspect | Hot shavings and chips<br>Cuts, burns, and eye injury<br>Drill breakage-Improper grind<br>Cuts and eye injury<br>Improper clamping of material<br>Cuts and abrasions |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine speeds and feeds | Size, shape, and composition of workpiece | Incorrect drill size<br>Improper clamping of workpiece<br>Improperly sharpened drill<br>Failure to use coolant |

(TASK STATEMENT) CENTER DRILL AND DRILL A HOLE ON THE DRILL PRESS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Relationship of force to distortion in an elastic body<br>Simple machines used to gain mechanical advantage<br>[Drill chuck gears]<br>Work input, work output, friction and efficiency in simple machines<br>[Drill efficiency]<br>Effect of heating and cooling on expansion of materials<br>[Changing of dimension of the drilled hole]<br>Transfer of heat from one body to another<br>[Coolant]<br>Motion resulting from two or more forces acting on a point in a body<br>[Workpiece must resist motion]<br>Effects of friction on work processes and product quality<br>[Deterioration of workpiece and tool]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials (tools, fixture)<br>Resistance of materials to change in shape | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Drill coding system]<br>Measures of length<br>[Measurement of length]<br>Multiplication and division with whole numbers<br>Multiplication and division of proper and improper fractions<br>Multiplication and division of decimal fractions<br>Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, trade terminology, detail inference, recognition of symbols, codes and emblems |
| Viewing | Inspect workpiece | Visual analysis, describing, logic, detail inference |
| Touching | Surface of workpiece | Size, shape, texture, and temperature |

(TASK STATEMENT) REAM A DRILLED HOLE ON A DRILL PRESS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Reamers<br>Drill chuck<br>Chuck key<br>Sleeve<br>Drift<br>Hammer<br>Holding devise<br>Plug gage<br>Micrometers<br>Vernier calipers<br>Coolant<br>Safety glasses | Select reamer<br>Mount work in holding device<br>Mount reamer in chuck<br>Apply coolant<br>Select feeds and speeds<br>Ream hole<br>Check hole diameter | Hot shavings and chips<br>Cuts, burns, and eye injury<br>Improper clamping of material<br>Cuts and abrasions<br>Avoid contact with rotating tools<br>Cuts and bruises |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine type of reamer to use<br>Determine proper speeds and feeds | Size and shape of hole<br><br>Size, shape, and composition of workpiece | Use wrong type of reamer<br>Lack of coolant<br>Running the reamer in reverse<br>RPM of reamer too high |

(TASK STATEMENT) REAM A DRILLED HOLE ON A DRILL PRESS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>[Clamps, T-bolds, jigs, and fixtures]<br>Work input, work output, friction and efficiency in simple machines<br>[Setting time]<br>Motion resulting from two or more forces acting on a point in a body<br>[Resistance to motion (torque)]<br>Relationship of force to distortion in an elastic body<br>Resistance of materials to change in shape<br>[Proper tightening torque]<br>Effects of friction on work processes and product quality<br>[Speed critical to dimensional accuracy] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Reamer sizing system]<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring and other than linear, square, and cubic)<br>Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Micrometers<br>Calipers<br>Gage | Visual analysis, logic, detail inference, recognition of codes, symbols, and emblems |
| Touching | Workpiece | Size, shape, texture, movement, and temperature |

(TASK STATEMENT) TAP HOLE USING TAPPING ATTACHMENT

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Tap<br>Tapping attachment<br>Coolant<br>Wrenches<br>Holding device<br>Safety glasses | Selection of tapping speed<br>Select tap<br>Clamp workpiece securely<br>Lubricate tap<br>Tap workpiece<br>Check threads | Tap breakage<br>Cuts and eye injury<br>Failure of holding device<br>Tap breakage<br>Cuts and bruises<br>Eye injuries |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select tap<br>Select speeds | Thread, size, and hole diameter<br><br>Size, shape, and composition of workpiece | Improper tap selection<br>Workpiece not clamped correctly |

(TASK STATEMENT) TAP HOLE USING TAPPING ATTACHMENT

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>[Clamps, T-bolds, jigs, and fixtures]<br>[Ratio of speeds between tapping attachment and spindle]<br>Work input, work output, friction and efficiency in simple machines<br>[Setting time]<br>[Excess speed deteriorates tools]<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements<br>[Properties of tapping lubricant]<br>Transfer of heat from one body to another<br>[Lubricant justification]<br>Effects of friction on work processes and product quality<br>[Excess friction detrimental to threads]<br>Relationship of force to distortion in an elastic body<br>Resistance of materials to change in shape<br>[Strength of tool] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Tap sizing system]<br>Read and interpret charts, tables, and/or graphs<br>[Tap drill chart]<br>Measures of length<br>Measure with the Metric and English system and convert between them |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Holding device | Visual analysis, logic, and detail inference |
| Touching | Workpiece | Size, shape, movement, and temperature |

(TASK STATEMENT) SPOTFACE A HOLE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Spotfacing tool<br>Pilot<br>Counterbore<br>Work holding device<br>Coolant<br>Scale<br>Safety glasses<br>Mics<br>Wrenches | Select proper spotface<br>Clamp work<br>Mount spotface in chuck<br>Apply coolant<br>Select speeds and feeds<br>Spotface hole to proper depth<br>Check hole | Keep hands clear of cutter<br>Cuts<br>Avoid hot shavings<br>Cuts and burns<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine feeds and speeds | Size, shape, and composition of workpiece | Lack of coolant<br>Running spotface in reverse<br>Vibrations |

(TASK STATEMENT) SPOTFACE A HOLE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>[Clamps, T-bolds, jigs, and fixtures]<br>Work input, work output, friction and efficiency in simple machines<br>[Setting time]<br>Motion resulting from two or more forces acting on a point in a body<br>[Resistance to motion (torque)]<br>Effects on friction on work processes and product quality<br>[Damage to tools by excess friction]<br>Transfer of heat from one body to another<br>[Lubricant justification] | Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Scale | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Workpiece | Size, shape, movement, texture, and temperature |

(TASK STATEMENT) COUNTERSINK A HOLE



| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Scale<br>Countersink<br>Drill chuck<br>Chuck key<br>Sleeve<br>Drift<br>Hammer | Select countersink<br>Clamp work<br>Mount countersink in chuck<br>Apply coolant<br>Select speeds and feeds<br>Countersink hole<br>Check hole | Keep hands clear of cut<br>Cuts<br>Avoid hot chips<br>Cuts and burns<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine speeds and feeds | Size, shape, and composition of workpiece | Lack of coolant<br>Running countersink in reverse<br>Vibrations |

(TASK STATEMENT) COUNTERSINK A HOLE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>[Clamps, T-bolds, jigs, and fixtures]<br>Work input, work output, friction and efficiency in simple machines<br>[Setting time]<br>Motion resulting from two or more forces acting on a point in a body<br>[Resistance to motion (torque)]<br>Effects of friction on work processes and product quality<br>[Damage to tool by excess friction]<br>Transfer of heat from one body to another<br>[Lubricant justification] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Angular sizing] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Scale | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Workpiece | Size, shape, movement, texture, and temperature |

(TASK STATEMENT) COUNTERBORE A HOLE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Counterbore<br>Pilot<br>Spotfacer<br>Drill chuck<br>Chuck key<br>Sleeve<br>Drift<br>Hammer<br>Wrenches<br>Coolant | Select counterbore<br>Clamp work<br>Mount counterbore in chuck<br>Apply coolant<br>Select speeds and feeds<br>Counterbore hole to proper depth<br>Check hole | Keep hands clear of cutter<br>Cuts<br>Avoid hot shavings<br>Cuts, burns, and eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine feeds and speeds | Size, shape, and composition of workpiece | Lack of coolant<br>Running counterbore in reverse<br>Vibrations |

(TASK STATEMENT) COUNTERBORE A HOLE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechaincal advantage<br>[Clamps, T-bolds, jigs, and fixtures]<br>Work input, work output, friction and efficiency in simple amchines<br>[Setting time]<br>Motion resulting from two or more forces acting on a point in a body<br>[Resistance to motion (torque)]<br>Effects of friction on work processes and product quality<br>[Damage to tools by excess friction]<br>Transfer of heat to one body to another<br>[Lubricant justification] | Measures of length<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Counterbore sizing] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Holding device | Visual analysis, logic, and detail inference |
| Touching | Workpiece | Size, shape, movement, and temperature |

(TASK STATEMENT) SET AND OPERATE DRILL PRESS CONTROLS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Wrenches<br>Chart for speeds and feeds | Adjust speed control<br>Adjust feed control<br>Start machine<br>Engage automatic feeds | Excessive speeds and feeds<br>Destroyed or broken cutting tools<br>Cuts<br>Eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine feeds and speeds<br>Determine when to use automatic feeds | Speed chart<br><br>Size, shape, and composition of workpiece | Improper feed and speed selection |

(TASK STATEMENT) SET AND OPERATE DRILL PRESS CONTROLS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Speed and feed controls]<br>Inertia and momentum (Body at rest and body in motion )<br>[When and how to adjust spindle speed and feeds] | Measure of time and speed (Example: time-seconds, minutes, etc., speed-feet per minute, R.P.M., etc.)<br>[R.P.M. gage]<br>Multiplication and division with whole numbers<br>Multiplication and division of proper and improper fractions<br>Multiplication and division of decimal fractions<br>[Feeds and speeds] |

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COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Drill press controls | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Controls | Tension, movement |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM DRILL PRESS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Scale<br>Blueprint<br>Mics<br>Hole gages<br>Wrenches<br>Vernier calipers | Remove part<br>Deburr part<br>Inspect part | Burrs on workpiece<br>Cuts<br>Handle tools and material properly<br>Cuts and burns<br>Material damage |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy required | Scale<br>Blueprint<br>Micrometer<br>Gage | Dirt or grit on part<br>Burrs on part<br>Incorrect tolerances |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM DRILL PRESS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Effects of friction on work processes and product quality<br>[Poor quality due to friction on workpiece or tool] | Measures of length |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint<br>Scale | Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems |
| Viewing | Micrometer<br>Calipers<br>Workpiece | Visual analysis, logic, detail inference |
| Touching | Workpiece<br>Micrometer | Size, shape, texture, tension, and movement |

Duty F Operating a Pedestal Grinder

1 Clean and lubricate pedestal and grinder
2 Select mount and dress grinding wheel for pedestal grinder
3 Grind and sharpen tool bits on a pedestal grinder
4 Sharpen twist drill with grinder
5 Interpret blueprint language

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(TASK STATEMENT) CLEAN AND LUBRICATE PEDESTAL AND GRINDER

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Oil<br>Grease<br>Oil can<br>Grease gun<br>Rags<br>Solvent<br>Brushes<br>Measuring containers<br>Lubrication charts<br>Abrasive material<br>Wrenches<br>Drop cord | Clean fittings before lubrication<br>Remove and install plug and covers<br>Make necessary adjustments<br>Start and stop machinery | Avoid chips<br>Cuts<br>Do not use pressurized air<br>Eye and machine damage<br>Shut machine off before cleaning<br>Electrical shock<br>Avoid spills<br>Falls<br>Proper disposal of lubricants and solvents<br>Fire<br>Water pollution |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine proper frequency of lubrication<br>Select proper lubricant<br>Locate all lubrication parts<br>Determine correct amount of lubricant | Operation manual guidelines<br>Type of machinery | Equipment malfunction |

(TASK STATEMENT) CLEAN AND LUBRICATE PEDESTAL GRINDER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, and elements<br>[Properties of lubricants]<br>Effects of friction on work processes and product quality<br>[Friction causes deterioration] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Society of Automotive Engineers Specifications]<br>[American Iron and Steel Institute Specifications]<br>Read and interpret charts, tables, and/or graphs<br>[Lubrication charts]<br>Liquid and dry measures<br>[Liquid measure] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operational manuals | Trade terminology, description of mechanism, definition, instructions |
| Viewing | Equipment | Visual analysis, describing, logic, detail inference, color discrimination |
| Touching | Equipment | Temperature, texture, movement, and tension |

(TASK STATEMENT) SELECT MOUNT AND DRESS GRINDING WHEEL FOR PEDESTAL GRINDER

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| TOOLS, EQUIPMENT, MATERIALS; OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Wheel dresser<br>Diamond<br>Mechanical<br>Stick<br>Grinding wheel<br>Wrenches<br>Safety glasses | Select wheel<br>Inspect wheel<br>Clean arbor<br>Install blotters<br>Install washers<br>Tighten nut<br>Install guards<br>Dress wheel | Use of damaged wheel<br>Cuts and abrasions<br>Eye injury<br>Improper dressing procedure<br>Damaged wheel<br>Cuts and abrasions<br>Eye injury<br>Failure to wear eye protection<br>Eye injury<br>Inadequate wheel guards<br>Cuts<br>Bruises<br>Eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select proper wheel<br>Select mounting procedures | Wheel selection chart | Incorrect wheel selection<br>Improper mounting<br>Guards not installed |

(TASK STATEMENT) SELECT MOUNT AND DRESS GRINDING WHEEL FOR PEDESTAL GRINDER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Effects of friction on work processes and product quality<br>[Types and strengths of grinding wheel]<br>Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Dressing device and wrenches]<br>Centrifugal forces developed by bodies in rotation<br>Centripetal forces developed by bodies in rotation<br>[Discharge of grinding wheel particles]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Strength of grinding wheels] | Measures of length<br>Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.)<br>[R.P.M.]<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Wrench sizing] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Wheel<br>Mount set-up | Visual analysis, detail inference, logic |
| Touching | Install washers<br>Nuts | Size, shape and tension |

(TASK STATEMENT) GRIND OR SHARPEN TOOL BITS ON A PEDESTAL GRINDER

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Tool bit<br>Safety galsses<br>Template<br>Protractor<br>Coolant<br>Radius gage<br>Center gage<br>Wrenches | Inspect wheel<br>Select tool bit<br>Select angles<br>Adjust tool rest<br>Grind angles<br>Cool tool bit<br>Check angles<br>Hone edges | Failure to cool tool properly<br>Cracked tools<br>Burns<br>Improperly held tool<br>Broken wheel<br>Eye injury<br>Cuts and abrasions<br>Improperly adjusted tool rest<br>Cuts<br>Bruises<br>Tool and/or wheel damage |
| **DECISIONS** | **CUES** | **ERRORS** |
| Select clearance and rake angles | Protractor<br>Radius and center gage | Overheating<br>Holding tool loosely<br>Tool rest too far from wheel |

(TASK STATEMENT) GRIND OR SHARPEN TOOL BITS ON A PEDESTAL GRINDER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Drive mechanisms]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Heat effects workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Materials fly out]<br>[Workpiece tends to be pulled out of your hand]<br>Inertia and momentum (Body at rest and body in motion)<br>Effects of friction on work processes and product quality<br>[Overheating will tend to anneal or soften tool bits]<br>Transfer of energy from one form to another<br>[Mechanical energy changes to heat] | Read and interpret charts, tables, and/or graphs<br>[Clearance and rake angles]<br>Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Protractor<br>Template<br>Gages | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Workpiece | Size, shape, texture, temperature |

(TASK STATEMENT) SHARPEN TWIST DRILL WITH GRINDER



| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Drill<br>Drill point gage<br>Safety glasses<br>Coolant | Select drill<br>Inspect wheel and dress<br>Adjust tool rest<br>Grind drill<br>Cool drill<br>Check grind with drill point gage | Failure to wear eye protector<br>Eye injury<br>Avoid contact with grinding wheel<br>Cuts and abrasions |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select correct angles | Drill point gage | Improper flute angles<br>Inadequate clearance angle (relief)<br>Unequal flute length |

(TASK STATEMENT) SHARPEN TWIST DRILL WITH GRINDER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Drive mechanisms]<br>Effect of heating and cooling on expansion of materials (Change dimensions)<br>[Materials fly out]<br>[Workpiece tends to be pulled out of your hand]<br>Inertia and momentum (Body at rest and body in motion)<br>Effects of friction on work processes and product quality<br>[Overheating will tend to anneal or soften tool bits]<br>Transfer of energy from one form to another<br>[Mechanical energy changes to heat] | Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)<br>[Drill point gage]<br>Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | **Wheel dresser**<br>Drill point gage | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Drill | Size, shape, texture, and temperature |

(TASK STATEMENT) INTERPRET BLUEPRINT LANGUAGE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Blueprint | Select appropriate print by code number<br>Identify and interpret symbols and schematics<br>Interpret locations and dimensions<br>Interpret sizes, shapes, and finishes | |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine measurement transfer, layout procedure to maintain accuracy of tolerance | Degree of accuracy indicated on drawings | Misinterpretation of blueprint dimensions |

(TASK STATEMENT) INTERPRET BLUEPRINT LANGUAGE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| | Determination of area and circumference of circles<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Blueprint code]<br>Read and interpret charts, tables, and/or graphs<br>Measure with the Metric and English system and convert between them<br>Measure of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)<br>Basic arithmetic skills<br>Determination of area, perimeter, and diagonals of quadrilaterals (4 sided figures); and polygons with more than 4 sides |

| COMMUNICATIONS | | |
|---|---|---|
| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
| Reading | Blueprint | Comprehension, trade terminology, description of mechanism, appropriate diction, enunciation, clarity of expression, instruction (oral and informal), logic, recommendation report (oral and informal) |

Duty G Setting Up and Operating Lathes

1 Clean and lubricate lathes
2 Grind and sharpen tool bits on a lathe
3 Sequence cutting tools and holder
4 Select and mount work and work holding device
5 Set and operate lathe controls
6 Face a workpiece
7 File a workpiece for burr removal
8 Hand finish a workpiece
9 Turn a shaft to a shoulder
10 Turn a taper on engine lathe
11 Knurl a workpiece
12 Cut off a workpiece with a parting tool
13 Cut with a form tool
14 Center drill and drill with a lathe
15 Bore a hole on a lathe
16 Thread a lathe
17 Grind with a tool post grinder on an engine lathe
18 Remove and inspect part from lathe

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(TASK STATEMENT) CLEAN AND LUBRICATE LATHES

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Oil<br>Solvent<br>Grease<br>Oil can<br>Grease gun<br>Rags<br>Brushes<br>Measuring containers<br>Lubrication charts<br>Abrasive material<br>Wrenches<br>Drop cord | Clean fittings before lubrication<br>Remove and install plug and covers<br>Make necessary adjustments<br>Start and stop machinery | Avoid chips<br>Cuts<br>Do not use pressurized air<br>Eye and machine damage<br>Shut machinery off before cleaning<br>Electrical shock<br>Avoid spills<br>Falls<br>Proper disposal of lubricants and solvents<br>Fire<br>Water pollution |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine proper frequency of lubrication<br>Select proper lubricant<br>Locate all lubrication points<br>Determine correct amount of lubricant | Operation manual guidelines<br>Type of machinery | Equipment malfunction |

(TASK STATEMENT) CLEAN AND LUBRICATE LATHES

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements<br>[Properties of lubricants]<br>Effects of friction on work processes and product quality<br>[Friction causes deterioration] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Society of Automotive Engineers Specifications]<br>[American Iron and Steel Institute Specifications]<br>Read and interpret charts, tables, and/or graphs<br>[Lubrication charts]<br>Liquid and dry measures<br>[Liquid measure] |

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COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operational manuals | Comprehension, trade terminology, description of mechanism, definition, instructions |

(TASK STATEMENT) GRIND OR SHARPEN TOOL BITS ON A LATHE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Tool bit<br>Safety glasses<br>Template<br>Protractor<br>Coolant<br>Radius gage<br>Center gage | Inspect wheel<br>Select tool bit<br>Select angles<br>Adjust tool rest<br>Grind angles<br>Cool tool bit<br>Check angles<br>Hone edges | Avoid overheating tool bit<br>Burns<br>Destroy tool<br>Avoid contacting wheel with fingers<br>Cuts and abrasions<br>Set tool rest close to wheel (16'')<br>Broken wheel<br>Cuts and abrasions<br>Eye injury<br>Wear safety glasses<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Select clearance and rake angles | Protractor<br>Radius and center gage | Overheating tool<br>Holding tool loosely<br>Tool rest too far from wheel |

(TASK STATEMENT) GRIND OR SHARPEN TOOL BITS ON A LATHE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechaincal advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Drive mechanisms]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Heat effects workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Materials fly out]<br>[Workpiece tends to be pulled out of your hand]<br>Inertia and momentum (Body at rest and body in motion)<br>Effects of friction on work processes and product quality<br>[Overheating will tend to anneal or soften tool bits]<br>Transfer of energy from one form to another<br>[Mechanical energy changes to heat] | Read and interpret charts, tables, and/or graphs<br>[Clearance and rake angles]<br>Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Protractor<br>Template<br>Gages | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Workpiece | Size, shape, texture, temperature |

(TASK STATEMENT) SEQUENCE CUTTING TOOLS AND HOLDERS

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Tool bits (carbide and steel)<br>Tool holders<br>Drill<br>Reamers<br>Boring bars<br>Mandrel<br>Driving dog<br>Grinder<br>Drill chuck<br>Drill sleeves<br>Drill drift<br>Hammer<br>Wrenches<br>Sleeve | Select tools and holders<br>Clean tools and holders<br>Install tools and holders | Proper handling of tools and holders<br>Cuts, abrasions<br>Damaged tools<br>Damaged holders |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine types of tools and holders<br>Determine sequence and procedures of mounting tools and holders | Size and shape of tools | Dirty tools and holders<br>Incorrect selection of tools and equipment |

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(TASK STATEMENT) SEQUENCE CUTTING TOOLS AND HOLDERS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Strength of holding device]<br>Effects of friction on work processes and product quality<br>[Selection of tool material]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Strength of material] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Wrench and cutting tool sizing] |

| COMMUNICATIONS | | |
|---|---|---|
| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
| Viewing | Mounting set-up<br>Tools | Visual analysis, logic, and detail inference |

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Four jaw chuck<br>Three jaw chuck<br>Steady rest<br>Follower rest<br>Centers<br>Drive plate and dog<br>Collet and drawbar<br>Face plate<br>Workpiece<br>Mandrel<br>Chuck wrench<br>Clamps | Select workholding device<br>Clean workholding device<br>Mount workholding device<br>Mount workpiece | Drop work or workholding device<br>Cuts or bruises<br>Part fly out of machine<br>Eye injury<br>Cuts and bruises |
| **DECISIONS** | **CUES** | **ERRORS** |
| Select proper workholding method<br>Select proper workholding device | Size and shape of workpiece | Dirty fixtures<br>Loose fixture<br>Springing the work by improper mounting<br>Loose work |

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORKHOLDING DEVICE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs, and fixtures]<br>Work input, work output, friction and efficiency in simple machines [Setting time]<br>Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)]<br>Relationship of force to distortion in an elastic body<br>Resistance of materials to change in shape [Proper tightening torque]<br>Centrifugal forces developed by bodies in rotation<br>Centripetal forces developed by bodies in rotation [Tendency of workpiece to fly out]<br>Inertia and momentum (Body at rest and body in motion )<br>Effects of friction on work processes and product quality | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Mount set-up | Visual analysis, detail inference, and logic |

(TASK STATEMENT) SET AND OPERATE LATHE CONTROLS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Speed and feed calculator or charts | Adjust speed control<br>Adjust feed control<br>Start machine<br>Engage automatic feeds | Excessive speeds and feeds<br>Destroyed or broken cutting tools<br>Cuts<br>Eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine feeds and speeds<br>Determine when to use automatic feeds | Speed chart<br>Formula of workpiece<br>Size, shape, and composition of workpiece | Improper speed and feed selection |

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(TASK STATEMENT) SET AND OPERATE LATHE CONTROLS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Speed and feed controls]<br>Inertia and momentum (Body at rest and body in motion )<br>[When and how to adjust spindle speed and feeds] | Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.)<br>[R.P.M.]<br>Read and interpret charts, tables, and/or graphs<br>[Lathe control chart]<br>Measure with the Metric and English system and convert between them |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Lathe controls | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Controls | Tension and movement |

(TASK STATEMENT) FACE A WORKPIECE

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Tool and holder<br>Coolant<br>Wrenches<br>Micrometers<br>Safety glasses<br>Scale<br>File<br>Vernier calipers | Start machine<br>Set to cut<br>Engage feed<br>Face workpiece<br>Deburr workpiece<br>Check piece | Avoid sharp edges<br>Cuts<br>Tool failure<br>Cuts and eye injury<br>Loose workpiece<br>Cuts and bruises<br>Failure to wear eye protection<br>Eye injury<br>Avoid contact with revolving work<br>Cuts and bruises<br>Broken bones |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine amount of stock to be removed | Use of workpiece | Tool failure |

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(TASK STATEMENT) FACE A WORKPIECE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials<br>(Change of dimensions )<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Workpiece flying off]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length |

SP1

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Micrometer<br>Caliper | Size, shape, texture, tension, and movement |

(TASK STATEMENT) FILE A WORKPIECE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>File and handle<br>Chuck<br>Collet<br>Wrenches<br>Safety glasses | Select file<br>Install handle<br>Start machine<br>File part<br>Check part | Avoid contact with revolving work<br>Cuts and bruises<br>Broken bones<br>Improper filing<br>Cuts and bruises<br>Eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select file of proper cut | Shape of workpiece<br>Amount of stock to be removed | Improper file selection<br>Incorrect filing procedure |

(TASK STATEMENT) FILE A WORKPIECE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements<br>[Selection of type of tool]<br>Effect of heating and cooling on expansion of materials<br>[Overheating distorts workpiece]<br>Centrifugal forces developed by bodies in rotation<br>Centripetal forces developed by bodies in rotation<br>[Workpiece flying out]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy] | Measures of length<br>Measure with the Metric and English system and convert between them |

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COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Collet<br>Workpiece | Visual analysis, logic, and detail inference |
| Touching | Workpiece | Size, shape, and texture |

(TASK STATEMENT) HAND FINISH A WORKPIECE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Emery cloth<br>Safety goggles<br>Chuck<br>Collets | Select emery cloth<br>Start machine<br>Finish surface of part<br>Check part | Avoid contact with revolving work<br>Cuts, bruises, and fractures<br>Improper use of emery cloth<br>Cuts and bruises |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Selection of emery cloth | Amount of stock to be removed | Excessive stock removal |

(TASK STATEMENT) HAND FINISH A WORKPIECE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements<br>[Selection of type of tool]<br>Effect of heating and cooling on expansion of materials<br>[Overheating distorts workpiece]<br>Centrifugal forces developed by bodies in rotation<br>Centripetal forces developed by bodies in rotation<br>[Workpiece flying out]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or Literal<br>[Grit texture] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Collet<br>Workpiece | Visual analysis, logic, and detail inference |
| Touching | Workpiece | Size, shape, and texture |

(TASK STATEMENT) TURN A SHAFT TO A SHOULDER

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Tool and holder<br>Micrometers<br>Micrometer stop<br>Wrenches<br>Scale<br>Safety glasses<br>Coolant | Start machine<br>Set to cut<br>Set stops<br>Turn on coolant<br>Turn part<br>Deburr<br>Check | Avoid contact with revolving work<br>Cuts, bruises, and fractures<br>Avoid sharp edges (tool and work)<br>Cuts<br>Failure to use eye protection<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine amount of cut to be taken<br>Determine setting of micrometer stops | Measuring devices | Incorrect stop setting<br>Tool failure |

(TASK STATEMENT) TURN A SHAFT TO A SHOULDER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Workpiece flying off]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length |

(2)

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Micrometer | Size, shape, temperature, tension, and movement |

(TASK STATEMENT) TURN A TAPER ON ENGINE LATHE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Chuck or collet<br>Workpiece<br>Tool and holder<br>Wrenches<br>Safety glasses<br>Blueprint<br>Plug gage<br>Indicator and holder<br>Micrometers<br>Scale<br>Coolant<br>Prussian Blue | Set taper<br>Compound rest<br>Taper attachment<br>Offset tailstock<br>Start machine<br>Turn on coolant<br>Turn taper<br>Check<br>Finish taper<br>Check | Avoid contact with revolving work<br>Cuts, bruises, and fractures<br>Avoid sharp edges (tool and work)<br>Cuts<br>Failure to use eye protection<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Select method of turning taper<br>Correct selection of taper angle | Blueprint<br>Measuring devices | Incorrect selection of taper angle |

(TASK STATEMENT) TURN A TAPER ON ENGINE LATHE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advatage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Workpiece flying off]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length<br>Use of trigonometric functions in solution of problems involving right triangles<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Degree coding system]<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic)<br>[Plug and ring gage] |

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COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, trade terminology, detail inference, and recognize symbols, codes, and emblems |
| Viewing | Workpiece<br>Collet<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, texture, tension, movement, and temperature |

(TASK STATEMENT) KNURL A WORKPIECE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Wrenches<br>Workpiece<br>Knurling tool<br>Chuck<br>Collet<br>Scale<br>Coolant<br>Center<br>Sleeve | Set knurl<br>Set feed<br>Start machine<br>Set cut<br>Install center in workpiece<br>Start coolant<br>Knurl<br>Check | Avoid contact with revolving work<br>Cuts, bruises, and fractures<br>Failure to wear eye protection<br>Eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine speed and feed selection | Depth of knurl desired<br><br>Size, shape, and composition of workpiece | Incorrect selection of knurl<br>Lack of coolant<br>Improperly supported work<br>Double cut |

(TASK STATEMENT) KNURL A WORKPIECE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cross feed screw exerts pressure]<br>Centrifugal forces developed by bodies in rotation<br>Centripetal forces developed by bodies in rotation<br>[Workpiece flying off]<br>Inertia and momentum (Body at rest and body in motion)<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage]<br>Effects of friction on work processes and product quality<br>[Tool wear effect part quality] | Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Collet<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, texture, tension, movement, and temperature |

(TASK STATEMENT) CUT OFF A WORKPIECE WITH A PARTING TOOL

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Blueprint<br>Tool and tool holder<br>Wrenches<br>Scale<br>Mics<br>File<br>Coolant | Start machine<br>Set to cut<br>Turn on coolant<br>Start cut off<br>Deburr<br>Cut off<br>Check part | Avoid contact with revolving work<br>Cuts, bruises, and fractures<br>Avoid sharp edges (tool and work)<br>Cuts<br>Failure to use eye protection<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Select speed and feed | Composition of metal<br>Size and shape of workpiece | Improper feed<br>Improper speed<br>Dull tool |

(TASK STATEMENT) CUT OFF A WORKPIECE WITH A PARTING TOOL

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials (Change of dimension )<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Workpiece flying off]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length<br>Measure with the Metric and English system and convert between them |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems |
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, texture, tension, movement, and temperature |

(TASK STATEMENT) CUT WITH A FORM TOOL

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Blueprint<br>Form tool<br>Coolant<br>Wrenches<br>Center<br>Sleeves<br>Scale<br>Mics<br>File | Set stops<br>Start machine<br>Set to cut<br>Install center in workpiece<br>Turn on coolant<br>Form part<br>Deburr<br>Check | Avoid contact with revolving work<br>Cuts, bruises, and fractures<br>Avoid sharp edges (tool and work)<br>Cuts<br>Failure to use eye protection<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Support of workpiece<br>Selection of feed and speed | Size, shape, and composition of workpiece | Incorrect speed and feed selection<br>Improper support of workpiece<br>Tool failure |

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(TASK STATEMENT) CUT WITH A FORM TOOL

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials (Change of dimension)<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Workpiece flying off]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems |
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, texture, tension, movement, and temperature |

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(TASK STATEMENT) CENTER DRILL AND DRILL WITH A LATHE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Center drill<br>Drill<br>Drill chuck<br>Chuck key<br>Sleeve<br>Coolant | Select proper drills<br>Clamp workpiece<br>Apply coolant<br>Center drill<br>Drill<br>Deburr<br>Inspect | Avoid contact with revolving work<br>Cuts, bruises, and fractures<br>Avoid sharp edges (tools and work)<br>Cuts<br>Failure to use eye protection<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Select holding method | Blueprint<br>Size and shape of workpiece | Incorrect drill size<br>Improper clamping of workpiece<br>Improperly sharpened drill<br>Failure to use coolant<br>Improper depth of center drill |

(TASK STATEMENT) CENTER DRILL AND DRILL WITH A LATHE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage [Drill chuck gears]<br>Work input, work output, friction and efficiency in simple machines [Drill efficiency]<br>Effect of heating and cooling on expansion of materials (Change of dimensions) [Changing dimension of the drilled hole]<br>Transfer of heat from one body to another [Coolant]<br>Motion resulting from two or more forces acting on a point in a body [Workpiece must resist motion]<br>Effects of friction on work processes and product quality [Deterioration of workpiece and tool]<br>Relationship of force to distortion in an elastic body [Distortion of workpiece]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape [Tools and fixtures] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Drill coding system]<br>Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, trade terminology, detail inference, recognition of symbols, codes, and emblems |
| Viewing | Inspect workpiece | Visual analysis, describing, logic, and detail inference |
| Touching | Surface of workpiece | Size, shape, texture, temperature |

(TASK STATEMENT) BORE A HOLE ON A LATHE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Boring bar and holder<br>Tool bit<br>Telescope gage<br>Micrometers<br>Wrenches<br>Scale<br>Chuck<br>Collet | Start machine<br>Set to cut<br>Set stops<br>Turn on coolant<br>Take first cut<br>Check<br>Take second cut<br>Deburr<br>Check | Avoid contact with revolving work<br>Cuts, bruises, and fractures<br>Avoid sharp edges (tool and work)<br>Cuts<br>Failure to use eye protection<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Setting depth of cut<br>Setting of stops | Size, shape, composition of workpiece | Cut too heavy<br>Stops set improperly |

(TASK STATEMENT) BORE A HOLE ON A LATHE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality [Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Workpiece flying off]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)<br>[Telescoping or small hole gage]<br>Addition and subtraction of proper and improper fractions<br>Addition and subtraction of decimal fractions |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Collet<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, texture, tension, movement, and temperature |

(TASK STATEMENT) THREAD ON A LATHE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Center<br>Sleeve<br>Threading tool<br>Center gage<br>Thread mics<br>Wrenches<br>Micrometer stop<br>Chuck<br>Collets<br>Boring bar and holder<br>Thread gage<br>Safety glasses<br>O.D. mics | Set to cut<br>Start machine<br>Use coolant<br>Start cut<br>Check<br>Take successive cuts<br>Deburr<br>Check | Avoid contact with revolving work<br>Cuts, bruises, and fractures<br>Avoid sharp edges (tool and work)<br>Cuts<br>Failure to use eye protection<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine setting of tool to work<br>Determine setting of threads per inch | Tap drill size | Incorrect threads per inch<br>Too heavy a cut<br>Tool failure |

(TASK STATEMENT) THREAD ON A LATHE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials (Change of dimensions )<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden a workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Workpiece flying off]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic )<br>[Screw pitch micrometer]<br>Addition and subtraction of proper and improper fractions<br>Addition and subtraction of decimal fractions<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Ability to read and set degree measurements] |

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COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Collet<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring de. | Size, shape, texture, tension, movement, and temperature |

(TASK STATEMENT) GRIND WITH A TOOL POST GRINDER ON AN ENGINE LATHE

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Tool post grinder<br>Grinding wheel<br>Chuck<br>Collet<br>Indicator and holder<br>Mics<br>Small hole gage<br>Telescope gage<br>Safety glasses<br>Plug gage<br>Wrenches | Set to grind<br>O.D.<br>I.D.<br>Set stops<br>Start grinder and machine<br>Take trial cut<br>Check<br>Grind to finish<br>Check | Prevent wheel breakage<br>Eye injuries<br>Avoid contact with revolving work<br>Cuts, bruises, and fractures<br>Avoid sharp edges (tool and work)<br>Cuts<br>Failure to use eye protection<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Wheel selection<br>Speed and feed selection | Length of shank or mandrel<br>Diameter of hole<br><br>Size, shape, and composition of workpiece | Incorrect wheel<br>Incorrect speed and feed<br>Incorrect rotation of part |

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(TASK STATEMENT) GRIND WITH A TOOL POST GRINDER ON AN ENGINE LATHE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden a workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Workpiece flying off]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Degrees]<br>Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute. R.P.M., etc.)<br>Measures of length |

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| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Collet<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, texture, tension, movement, and temperature |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM LATHE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Wrenches<br>Mics<br>Blueprint<br>Scale<br>Vernier calipers | Remove part<br>Deburr part<br>Inspect part | Burrs on workpiece<br>Cuts<br>Handle tools and material properly<br>Cuts and burns<br>Material damage |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy required | Scale, blueprint, and micrometer gage | Dirt or grit on part<br>Burrs on part<br>Incorrect tolerances |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM LATHE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Effect of friction on work processes and product quality<br>[Poor quality due to friction on workpiece or tool] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and isgnificant digits (Measuring)<br>other than linear, square, and cubic |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Scale<br>Calipers<br>Micrometer | Visual analysis, logic, detail inference, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Micrometer | Size, shape, movement, texture, and temperature |
| Reading | Blueprint | Comprehension, detail inference, logic, and trade terminology |

Duty H Setting Up and Operating Shaper and Slotter

1 Clean and lubricate shaper and slotter
2 Grind or sharpen tool bit
3 Select and mount cutting tool and holders
4 Select and mount work and work holding devices
5 Set and operate shaper and slotter controls
6 Shape or slot part to drawing specifications
7 Remove and inspect part from shaper and slotter

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(TASK STATEMENT) CLEAN AND LUBRICATE SHARPER AND SLOTTER

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Oil<br>Grease<br>Oil can<br>Grease gun<br>Rags<br>Solvent<br>Brushes<br>Measuring containers<br>Lubrication charts<br>Abrasive materials<br>Wrenches<br>Drop cord | Clean fittings before lubrication<br>Remove and install plug and covers<br>Make necessary adjustments<br>Start and stop machinery | Avoid chips<br>Cuts<br>Do not use pressurized air<br>Eye and machine damage<br>Shut machine off before cleaning<br>Electrical shock<br>Avoid spills<br>Falls<br>Proper disposal of lubricants and solvents<br>Fire<br>Water pollution |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine proper frequency of lubrication<br>Select proper lubricant<br>Locate all lubrication points<br>Determine correct amount of lubricant | Operation manual guidelines<br>Type of machinery | Equipment malfunction |

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(TASK STATEMENT) CLEAN AND LUBRICATE SHARPER AND SLOTTER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, and elements<br>[Properties of lubricants]<br>Effects of friction on work processes and product quality<br>[Friction causes deterioration] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Society of Automotive Engineers Specifications]<br>[American Iron and Steel Institute Specifications]<br>Read and interpret charts, tables, and/or graphs<br>[Lubrication charts]<br>Liquid and dry measures<br>[Liquid measures] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operational manuals | Comprehension, trade terminology, description of mechanisms, definition, and instructions |
| Viewing | Equipment | Visual analysis, describing, logic, detail inference, color discrimination |
| Touching | Equipment | Temperature, texture, movement, and tension |

(TASK STATEMENT) GRIND OR SHARPEN TOOL BIT

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Tool bit<br>Safety glasses<br>Template<br>Protractor<br>Coolant<br>Radius gage<br>Center gage | Inspect wheel<br>Select tool bit<br>Select angles<br>Adjust tool rest<br>Grind angles<br>Cool tool bit<br>Check angles<br>Hone edges | Failure to cool tool properly<br>Cracked tool<br>Burns<br>Improperly held tool<br>Broken wheel<br>Eye injury<br>Cuts and abrasions<br>Improper adjustment of tool rest<br>Cuts<br>Bruises<br>Tool and/or wheel damage |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select clearance and rake angles | Protractor<br>Radius and center gage | Overheating tool<br>Holding tool loosely<br>Tool rest too far from wheel |

(TASK STATEMENT) GRIND OR SHARPEN TOOL BIT

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Drive mechanisms]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Heat effects workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Workpiece tends to be pulled out of your hand]<br>[Materials fly out]<br>Inertia and momentum (Body at rest and body in motion)<br>Effects of friction on work processes and product quality<br>[Overheating will tend to anneal or soften tool bits]<br>Transfer of energy from one form to another<br>[Mechanical energy changes to heat] | Read and interpret charts, tables, and/or graphs<br>[Clearance and rake angles]<br>Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Protractor<br>Template<br>Gages | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Workpiece | Size, shape, texture, temperature |

(TASK STATEMENT) SELECT AND MOUNT CUTTING TOOLS AND HOLDERS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Tool bit<br>Tool holder<br>Wrenches | Select tool and holder<br>Clean tool and holder<br>Install tool and holder | Proper handling of tools and holders<br>Cuts, abrasions<br>Damaged tools<br>Damaged holders |

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| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine types of tools and holders<br>Determine sequence and procedure of mounting tools and holders | Size and shape of tools | Dirty tools and holders<br>Incorrect selection of tools and equipment |

(TASK STATEMENT) SELECT AND MOUNT CUTTING TOOLS AND HOLDERS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Strength of holding device]<br>Effects of friction on work processes and product quality<br>[Selection of tool material]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Strength of material] | Read and interpret charts, tables, and/or graphs<br>[Clearance and rake angles]<br>Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Mounting set-up<br>Tools | Visual analysis, logic, and detail inference |

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Vise<br>Clamps<br>Wrenches<br>Scale<br>Surface 'gage<br>Index head<br>Vee blocks<br>Parallels | Select proper work holding device<br>Clean table and work holding device<br>Mount work holding device on table<br>Mount work in work holding device | Holding device not tight<br>Cuts and abrasions<br>Work not clamped tightly<br>Cuts and abrasions |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine type of holding device<br>Determine how to mount holding device | Size and shape of workpiece | Dirty table<br>Work holding device not tight<br>Work improperly clamped |

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(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>[Clamps, T-bolds, jigs, and fixtures]<br>Work input, work output, friction and efficiency in simple machines<br>[Setting time]<br>Motion resulting from two or more forces acting on a point in a body<br>[Resistance to motion (torque)]<br>Relationship of forces to distortion in an elastic body<br>Resistance of materials to change in shape<br>[Proper tightening torque] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Wrench sizes] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Scale<br>Gage<br>Workpiece<br>Mounting | Visual analysis, detail inference, logic, and describing |
| Touching | Workpiece<br>Mounting | Size, shape, tension, and movement |

(TASK STATEMENT) SET AND OPERATE SHAPER AND SLOTTER CONTROLS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Speeds and feed calculator or chart | Adjust speed control<br>Adjust feed control<br>Start machine<br>Engage automatic feeds | Excessive speeds and feeds<br>Destroyed or broken cutting tools<br>Cuts<br>Eye injury<br>Avoid moving tool and ram<br>Cuts<br>Bruises<br>Fractures |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine feeds and speeds<br>Determine when to use automatic feeds | Speed chart<br>Formula of workpiece<br>Size, shape, and composition of workpiece | Improper feed and speed selection |

(TASK STATEMENT) SET AND OPERATE SHAPER AND SLOTTER CONTROLS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Speed and feed controls]<br>Inertia and momentum (Body at rest and body in motion)<br>[When and how to adjust spindle speed and feeds] | Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.)<br>[Speed]<br>Read and interpret charts, tables, and/or graphs<br>[Shaper and slotter controls]<br>Measure with the Metric and English system and convert between them |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Shaper and slotter controls | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Contols | Tension and movement |

(TASK STATEMENT) SHAPE OR SLOT PART TO DRAWING SPECIFICATIONS



| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Safety glasses<br>Workpiece<br>Coolant<br>Tool and holder<br>Micrometers<br>Scale | Set cut depth<br>Adjust length and position of stroke<br>Shape or slot part<br>Check part | **Avoid moving**<br>Shaper cutting tool<br>Cuts and abrasions<br>Flying chips<br>Cuts, burns, and eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine length and position of stroke for proper over run | Amount of clearance on each end | Incorrect feeds and speeds<br>Incorrect length or position of stroke |

(TASK STATEMENT) SHAPE OR SLOT PART TO DRAWING SPECIFICATIONS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Inertia and momentum (Body at rest and body in motion)<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Workpiece flying off]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Read and interpret charts, tables, and/or graphs<br>[Machine control charts] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Micrometer | Size, shape, tension, and movement |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM SHAPER AND SLOTTER

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Scale<br>Blueprint<br>Mics<br>Verniers | Remove part<br>Deburr part<br>Inspect part | Burrs on workpiece<br>Cuts<br>Handle tools and material properly<br>Cuts and burns<br>Material damage |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy required | Scale<br>Blueprint<br>Micrometer<br>Gage | Dirt or grit on part<br>Burrs on part<br>Incorrect tolerances |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM SHAPER AND SLOTTER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Effects of friction on work processes and product quality<br>[Poor quality due to friction on workpiece or tool] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint<br>Scale | Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems |
| Viewing | Micrometer<br>Calipers<br>Workpiece | Visual analysis, logic, and detail inference |
| Touching | Workpiece<br>Micrometer | Size, shape, texture, tension, and movement |

Duty I Set Up and Operating Horizontal and Vertical Milling Machine

1 Clean and lubricate milling machine
2 Select and mount work and work holding devices
3 Select and mount cutter holding devices and cutter
4 Set and operate milling machine controls
5 Index work with the dividing head
6 Mill a flat surface
7 Mill a keyway
8 Center drill and drill a hole on the vertical mill
9 Bore a hole with a mill
10 Mill an angular surface
11 Mill a dovetail on a vertical mill
12 Gang mill on a horizontal mill
13 Remove and inspect work from milling machine

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(TASK STATEMENT) CLEAN AND LUBRICATE VERTICAL MILLING MACHINE



| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Oil<br>Grease<br>Oil can<br>Grease gun<br>Rags<br>Solvent<br>Brushes<br>Measuring containers<br>Lubrication charts<br>Abrasive materials<br>Wrenches<br>Drop cord | Clean fittings before lubrication<br>Remove and install plug and covers<br>Make necessary adjustments<br>Start and stop machinery | Avoid chips<br>Cuts<br>Do not use pressurized air<br>Eye and machine damage<br>Shut machine off before cleaning<br>Electrical shock<br>Avoid spills<br>Falls<br>Proper disposal of lubricants and solvents<br>Fire<br>Water pollution |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine proper frequency of lubrication<br>Select proper lubricant<br>Locate all lubrication points<br>Determine correct amount of lubricant | Operation manual guidelines<br>Type of machinery | Equipment malfunction |

(TASK STATEMENT) CLEAN AND LUBRICATE VERTICAL MILLING MACHINE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements<br>[Properties of lubricants]<br>Effects of friction on work processes and product quality<br>[Friction causes deterioration] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Society of Automotive Engineers Specifications]<br>[American Iron and Steel Institute Specifications]<br>Read and interpret charts, tables, and/or graphs<br>[Lubrication charts]<br>Liquid and dry measures<br>[Liquid measure] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operational manuals | Comprehension, trade terminology, description of mechanism, definition, and instructions |
| Viewing | Equipment | Visual analysis, describing, logic, detail inference, color discrimination |
| Touching | Equipment | Temperature, texture, movement, and tension |

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORKHOLDING DEVICES

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Vise<br>Wrenches<br>Clamps<br>Bolts and nuts<br>Vee blocks<br>Parallels<br>Dividing head<br>Footstock<br>Rotary table<br>Dial indicator<br>Scale<br>Thickness gauge<br>Screw jack<br>Surface gage | Select proper work holding device<br>Clean table and work holding device<br>Mount work holding device on table<br>Mount work in work holding device | Holding device not tight<br>Cuts and abrasions<br>Work not clamped tightly<br>Cuts and abrasions |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine type of holding device<br>Determine how to mount holding device | Size and shape of workpiece | Dirty table<br>Work holding device not tight<br>Work improperly clamped |

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORKHOLDING DEVICES

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs, and fixtures]<br>Work input, work output, friction and efficiency in simple machines [Setting time]<br>Motion resulting from two or more forces acting on a point in a body [Resistance to motion (corque)]<br>Relationship of force to distortion in an elastic body<br>Resistance of materials to change in shape [Proper tightening torque] | Given a coding system, recognize and identify each unit involved by assigning necessary sumbols, numerical or literal [Wrench sizes] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece Mounting<br>Scale<br>Gage | Visual analysis, detail inference, logic, and describing |
| Touching | Workpiece Mounting | Size, shape, tension, and movement |

(TASK STATEMENT) SELECT AND MOUNT CUTTER HOLDING DEVICES AND CUTTER

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Cutter<br>Arbor<br>Collet<br>Wrenches | Select tool and holder<br>Clean tool and holder<br>Install tool and holder | Proper handling of tools and holders<br>Cuts and abrasions<br>Damaged tools<br>Damaged holders |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine types of tools and holders<br>Determine sequence and procedures of mounting tools and holders | Size and shape of tools | Dirty tools and holders<br>Incorrect selection of tools and equipment |

(TASK STATEMENT) SELECT AND MOUNT CUTTER HOLDING DEVICES AND CUTTER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Strength of holding device]<br>Effects of friction on work processes and product quality<br>[Selection of tool material]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>Resistance of materials to change in shape<br>[Strength of material] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Size coding system]<br>Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Mounting set-up<br>Tools | Visual analysis, logic, and detail inference |

(TASK STATEMENT) SET AND OPERATE MILLING MACHINE CONTROLS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Speed charts<br>Feed charts<br>Gearing charts | Adjust speed control<br>Adjust feed control<br>Start machine<br>Engage automatic feeds | Excessive speeds and feeds<br>Destroyed or broken cutting tools<br>Cuts<br>Eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine feeds and speeds<br>Determine when to use automatic feeds | Speed chart<br><br>Size, shape, and composition of workpiece | Improper feed and speed selection |

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(TASK STATEMENT) SET AND OPERATE MILLING MACHINE CONTROLS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Speed and feed controls]<br>Inertia and momentum (Body at rest and body in motion)<br>[When and how to adjust spindle speed and feeds] | Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.)<br>[R.P.M.]<br>Read and interpret charts, tables, and/or graphs<br>[Speed and feed charts]<br>Measure with the Metric and English system and convert between them |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Milling machine controls | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Controls | Tension and movement |

(TASK STATEMENT) INDEX WORK WITH THE DIVIDING HEAD

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Wrenches<br>Clamps<br>Bolts and nuts<br>Dial indicator<br>Surface gage<br>Dividing head<br>Footstock<br>Scale<br>Mics<br>Milling cutters<br>Safety glasses<br>Coolant | Select indexing plate<br>Apply coolant<br>Cut workpiece<br>Index as required<br>Cut workpiece after each indexing operation<br>Check workpiece | Keep hands clear of revolving cutters<br>Cuts and abrasions |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine proper indexing plate to use<br>Determine speeds and feeds | Size, shape, and composition of workpiece | Incorrect indexing procedures<br>Lack of coolant<br>Not allowing for backlash |

(TASK STATEMENT) INDEX WORK WITH THE DIVIDING HEAD

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Ratio of gearing] | Determination of facts involving sectors of a circle<br>Ratio and proportion<br>Basic arithmetic skills<br>Manipulation of formula involving three factors<br>Determination of area and circumference of circles<br>Read and interpret charts, tables, and/or graphs<br>[Machinist's Handbook (Gears and Gearing)] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

(TASK STATEMENT) MILL A FLAT SURFACE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Collet<br>Arbor<br>Wrenches<br>Vise<br>Dividing head<br>Footstock<br>End mill<br><br>Slab mill<br>Fly cutter<br>Mics<br>Coolant<br>Safety glasses | Select speeds and feeds<br>Set for depth of cut<br>Apply coolant<br>Mill workpiece<br>Check workpiece | Avoid revolving cutters<br>Cuts<br>Avoid contact of cutter or spindle to work holding device<br>Damage to spindle or work holding device |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine speeds and feeds<br>Determine depth of cut<br>Determine when to sharpen cutter | Size, shape, and composition of workpiece | Improper speeds and feeds<br>Lack of coolant<br>Rough cut or finished surface<br>Climb milling |

(TASK STATEMENT) MILL A FLAT SURFACE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Overheating distorts workpiece]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length<br>Addition and subtraction of whole numbers<br>Measure with the Metric and English system and convert between them |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

(TASK STATEMENT) MILL A KEYWAY

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Woodruff key cutter<br>Blueprint<br>End mill<br>Side milling cutter<br>Inspection equipment<br>Mics<br>Vise<br>Parallels<br>Dividing head<br>Footstock<br>Coolant<br>Safety glasses | Select speeds and feeds<br>Set for depth of cut<br>Apply coolant<br>Mill workpiece<br>Check workpiece | Avoid revolving cutters<br>Cuts<br>Avoid contact of cutter or spindle to work holding device<br>Damage to spindle or work holding device |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine speeds and feeds<br>Determine depth of cut<br>Determine when to sharpen cutter | Size, shape, and composition of workpiece<br>Use of Machinist's Handbook | Improper speeds and feeds<br>Lack of coolant<br>Rough cut on finished surface<br>Climb milling |

(TASK STATEMENT) MILL A KEYWAY

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Overheating distorts workpiece]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length<br>Addition and subtraction of whole numbers<br>Measure with the Metric and English system and convert between them |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

(TASK STATEMENT) CENTER DRILL AND DRILL A HOLE ON THE VERTICAL MILL

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Drill chuck<br>Chuck key<br>Center drill<br>Drill<br>Vise<br>Clamps<br>Scale<br>Vernier calipers<br>Plug gage<br>Safety glasses<br>Coolant | Select proper drills<br>Clamp workpiece<br>Apply coolant<br>Center drill<br>Drill<br>Deburr<br>Inspect | Piece clamped properly to prevent movement<br>Cuts and bruises<br>Drill sharpened properly for material to be drilled<br>Cuts and eye injury<br>Broken drill<br>Hot shavings and chips<br>Cuts and burns |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select holding method | Blueprint<br>Size and shape of workpiece | Incorrect drill size<br>Improper clamping of workpiece<br>Improperly sharpened drill<br>Failure to use coolant |

(TASK STATEMENT) CENTER DRILL AND DRILL A HOLE ON THE VERTICAL MILL

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage [Drill chuck gears]<br>Work input, work output, friction and efficiency in simple machines [Drill efficiency]<br>Effect of heating and cooling or expansion of materials (Change of dimensions) [Changing of dimension of the drilled hole]<br>Transfer of heat from one body to another [Coolant]<br>Motion resulting from two or more forces acting on a point in a body [Workpiece must resist motion]<br>Effects of friction on work processes and product quality [Deterioration of workpiece and tool]<br>Relationship of force to distortion in an elastic body [Distortion of workpiece]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of material<br>Resistance of materials to change in shape [Fixtures] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Drill coding systems]<br>Measures of length<br>Multiplication and division with whole numbers<br>Multiplication and division of proper and improper fractions<br>Multiplication and division of decimal fractions<br>Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

(TASK STATEMENT) BORE A HOLE WITH A MILL

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Adjustable boring head<br>Wrenches<br>Dial indicator<br>Collets<br>Mics<br>Verniers<br>Telescope gages<br>Vise<br>Clamps<br>Tee nuts and bolts<br>Circular table | Select speeds and feeds<br>Adjust boring head for depth of cut<br>Apply coolant<br>Bore workpiece<br>Check workpiece | Avoid revolving cutters<br>Cuts<br>Avoid contact of cutter or spindle to work holding device<br>Damage to spindle or work holding device<br>Cutter damage<br>Cuts<br>Abrasions<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine speeds and feeds<br>Determine depth of cut<br>Determine when to sharpen cutter | Size, shape, composition of workpiece | Improper speeds and feeds<br>Lack of coolant<br>Rough cut on finished surface |

(TASK STATEMENT) BORE A HOLE WITH A MILL

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)<br>[Telescoping or small hole gage]<br>Addition and subtraction of proper and improper fractions<br>Addition and subtraction of decimal fractions |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

(TASK STATEMENT) MILL AN ANGULAR SURFACE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Blueprint<br>Fly cutter<br>Slab mill<br>End mill<br>Arbor<br>Collets<br>Vise<br>Clamps<br>Parallels<br>Tee nuts and bolts<br>Wrenches<br>Double angle cutter<br>Shell end mill<br>Surface gage<br>Mics<br>Dial indicator<br>Scale<br>Combination square | Select speed and feeds<br>Set depth of cut<br>Apply coolant<br>Cut angle<br>Swivel table<br>Swivel vice<br>Tilt head<br>Tilt workpiece<br>Use angular cutter<br>Check workpiece | Avoid revolving cutters<br>Cuts<br>Avoid contact of cutter or spindle to work holding device<br>Damage to spindle or work holding device<br>Cuts<br>Bruises<br>Eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine speeds and feeds<br>Determine depth of cut<br>Determine when to sharpen cutter | Size, shape, and composition of workpiece | Improper speed and feeds<br>Lack of coolant<br>Rough cut on finished surface<br>Climb milling |

(TASK STATEMENT) MILL AN ANGULAR SURFACE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length<br>Addition and subtraction of whole numbers<br>Addition and subtraction of proper and improper fractions<br>Addition and subtraction of decimal fractions |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

(TASK STATEMENT) MILL A DOVETAIL

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Vise<br>Collets<br>Arbor<br>Workpiece<br>Clamps<br>Tee nuts and studs<br>Dove tail cutter<br>Mics<br>Safety glasses<br>Wrenches<br>Coolant | Select speed and feeds<br>Set for depth of cut<br>Apply coolant<br>Mill workpiece<br>Check workpiece | Avoid revolving cutters<br>Cuts<br>Avoid contact of cutter or spindle to work holding device<br>Damage to spindle or work holding device |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine speeds and feeds<br>Determine depth of cut<br>Determine when to sharpen cutter | Size, shape, and composition of workpiece | Improper speeds and feeds<br>Lack of coolant<br>Rough cut on finished surface<br>Climb milling |

(TASK STATEMENT) MILL A DOVETAIL

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials (Change of dimension)<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Measures of length<br>Addition and subtraction of whole numbers<br>Addition and subtraction of proper and improper fractions<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Degrees] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

(TASK STATEMENT) GANG MILL ON A HORIZONTAL MILL

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY -- HAZARD |
|---|---|---|
| Arbor<br>Milling cutters<br>Mics<br>Vise<br>Fixture (workholding)<br>Clamps<br>Tee nuts and studs<br>Indicator<br>Safety glasses<br>Coolant<br>Thickness gage<br>Wrenches<br>Parallels | Select spacers and shims for correct spacing of cutters<br>Select speeds and feeds<br>Set depth of cut<br>Apply coolant<br>Mill workpiece<br>Check workpiece | Avoid revolving cutters<br>Cuts<br>Avoid contact of cutter or spindle to work holding device<br>Damage to spindle or work holding device |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine speeds and feeds<br>Determine depth of cut<br>Determine when to sharpen cutters<br>Determine number of cutters to use | Size, shape, and composition of workpiece | Improper feeds and speeds<br>Lack of coolant<br>Improper spacing of cutters<br>Rough cut on finished surface<br>Climb milling |

(TASK STATEMENT) GANG MILL ON A HORIZONTAL MILL

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Cutting tool]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Overheating distorts workpiece]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Coolant usage-mechanical to heat energy]<br>Effects of friction on work processes and product quality<br>[Tool wear effects accuracy]<br>[Tendency to workharden workpiece]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wear resistance of tool] | Addition and subtraction of decimal fractions<br>Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic ) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

(TASK STATEMENT) REMOVE AND INSPECT WORK FROM MILLING MACHINE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Blueprint<br>Mics<br>Wrenches<br>Scale<br>File<br>Surface indicator | Remove part<br>Deburr part<br>Inspect part | Burrs on workpiece<br>Cuts<br>Handle tools and material properly<br>Cuts and abrasions<br>Material damage<br>Burns |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy required | Scale<br>Blueprint<br>Micrometer<br>Gage | Dirt or grit on part<br>Burrs on part<br>Incorrect tolerances |

(TASK STATEMENT) REMOVE AND INSPECT WORK FROM MILLING MACHINE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Effects of friction on work processes and product quality<br>[Poor quality due to friction on workpiece or tool] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic ) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |
| Reading | Blueprint | Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems |

Duty J Performing Heat Treating Operations

1 Set furnace controls
2 Heat workpiece
3 Quench or cool workpiece
4 Remove and inspect part after heat treatment

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(TASK STATEMENT) SET FURNACE CONTROLS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Temperature indicator<br>Torch controls<br>Flame source | Turn on gas or electrical power<br>Set temperature indicator to desired point<br>Light furnace (if applicable)<br>Light torch (if applicable) | Care when lighting a furnace<br>Burns<br>Watch for gas leaks<br>Improper ignition<br>Gas fumes |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine proper temperature | Failure of furnace to light | Set controls at wrong temperature |

(TASK STATEMENT) SET FURNACE CONTROLS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Effect of heating and cooling on expansion of materials [Recognize thermal expansion]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Isothermal structure (3-T curves)] | Read and interpret charts, tables, and/or graphs [Temperature chart]<br>Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) [Time]<br>Measures of temperature<br>Measure with the Metric and English system and convert between them [Centigrade]<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Pyrometer] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Temperature of indicator | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |

(TASK STATEMENT) HEAT WORKPIECE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Oven<br>Torch | Put workpiece in furnace or light torch<br>Close furnace door (if applicable) | Keep clear of furnace and workpiece<br>Burns<br>Apply heat slowly and evenly<br>Distortion of workpiece |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine whether to use torch or furnace<br>Determine temperature or color desired | Uneven heating of workpiece | Overheating or underheating workpiece |

(TASK STATEMENT) HEAT WORKPIECE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Usage of tongs to put work in furnace]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>Resistance of materials to change in shape<br>[Recognize thermal changes]<br>Transfer of heat from one body to another<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Rate of heat flow in heat treating] (heating and cooling)<br>Temperature measurement is critical<br>Be aware of warpage in heat treatment | Measures of temperature |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece | Visual analysis, logic, and detail inference |

(TASK STATEMENT) QUENCH OR COOL WORKPIECE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Quenching media<br>Oil<br>Water<br>Brine<br>Air<br>Tongs | Remove workpiece from furnace<br>Pack in sand or let air cool<br>Quench in solution<br>Oil<br>Brine<br>Water<br>Air | Avoid contact with hot workpiece or furnace<br>Burns<br>Avoid spills of liquids<br>Falls, bruises, and cuts |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine type of quench<br>Determine type of quenching solution | Composition and shape of workpiece<br>Degree of hardness desired | Quenching too fast<br>Quenching in wrong solution |

(TASK STATEMENT) QUENCH OR COOL WORKPIECE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Usage of tongs to hold work]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>Resistance of materials to change in shape<br>[Recognition of dimensional change]<br>Transfer of heat from one body to another<br>[Rate of cooling in quenching]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Isothermal transformation] | Read and interpret charts, tables, and/or graphs<br>[Quenching solution chart] |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Conversion chart | Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems |
| Viewing | Test equipment<br>Workpiece | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Surface<br>Texture | |

(TASK STATEMENT) REMOVE AND INSPECT PART AFTER HEAT TREATMENT

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>File<br>Hardness testing equipment<br>Hardness conversion chart<br>Safety glasses<br>Tongs<br>Wire brush | Remove from quenchen tongs<br>Clean part<br>Remove scale from area to be tested<br>Take reading on test equipment | Be sure workpiece [illegible]ol<br>Burns |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of hardness | Test equipment readings<br>Hardness conversion chart | Incorrect hardness<br>Heated incorrectly<br>Quenched improperly<br>Improper selection of material<br>Distorted part<br>Uneven heating<br>Uneven quench |

(TASK STATEMENT) REMOVE AND INSPECT PART AFTER HEAT TREATMENT

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Use of a hardness tester]<br>Hardness test<br>Relationship of force to distortion in an elastic body<br>[Rockavell and Brinell hardness tester]<br>Resistance of materials to change in shape<br>[Scleroscope hardness tester]<br>[File test for hardness (resistance to abrasions)] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)<br>[Hardness testing]<br>Read and interpet charts, tables, and/or graphs<br>[Conversion charts (hardness)] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Conversion chart | Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems |
| Viewing | Test equipment<br>Workpiece | Visual analysis, logic, detail inference, recognize symbols, codes, and emblems |
| Touching | Surface<br>Texture | |

Duty K Setting Up and Operating Surface Grinder

1 Clean and lubricate surface grinder
2 Select, mount and dress grinding wheel
3 Select and mount work and work holding device
4 Set stops, feed and grind workpiece
5 Remove and inspect part from surface grinder

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(TASK STATEMENT) CLEAN AND LUBRICATE SURFACE GRINDER

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Oil<br>Grease<br>Oil can<br>Grease gun<br>Rags<br>Solvent<br>Brushes<br>Measuring containers<br>Lubrication charts<br>Abrasive material<br>Wrenches<br>Drop cord | Clean fittings before lubrication<br>Remove and install plug and covers<br>Make necessary adjustments<br>Start and stop machinery | Do not use pressurized air<br>Eye and machine damage<br>Shut machine off before cleaning<br>Electrical shock<br>Avoid spills<br>Falls<br>Proper disposal of lubricants and solvents<br>Fire<br>Water pollution |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine proper frequency of lubrication<br>Select proper lubricant<br>Locate all lubricantion points<br>Determine correct amount of lubricant | Operation manual guidelines<br>Type of machinery | Equipment malfunction |

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(TASK STATEMENT) CLEAN AND LUBRICATE SURFACE GRINDER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, and elements<br>[Properties of lubricants]<br>Effects of friction on work processes and product quality<br>[Friction causes deterioration] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Society of Automotive Engineers Specifications]<br>[American Iron and Steel Institute Specifications]<br>Read and interpret charts, tables, and/or graphs<br>[Lubrication charts]<br>Liquid and dry measures<br>[Liquid measure] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operational manuals | Comprehension, trade terminology, description of mechanism, definition and instructions |
| Viewing | | Visual analysis, describing, logic, detail inference, color discrimination |
| Touching | Equipment | Temperature, texture, movement, and tension |

(TASK STATEMENT) SELECT, MOUNT, AND DRESS GRINDING WHEEL FOR SURFACE GRINDER

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Wheel dresser<br>Diamond<br>Mechanical<br>Stick<br>Grinding wheel<br>Wrenches<br>Safety glasses | Select wheel<br>Inspect wheel<br>Clean arbor<br>Install blotters<br>Install washers<br>Tighten nut<br>Install guards<br>Dress wheel | Improper dressing procedure<br>Damaged wheel<br>Cuts and bruises<br>Eye injury<br>Failure to wear eye protection<br>Eye injury<br>Use of damaged wheel<br>Cuts and abrasions<br>Eye injury<br>Inadequate wheel guards<br>Cuts and abrasions<br>Eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select wheel<br>Determine correct mounting procedures | Type of grinding performance desired<br>Tension of adaptor flanges | Incorrect wheel selection<br>Improper mounting<br>Guards not installed |

(TASK STATEMENT) SELECT, MOUNT, DRESS GRINDING WHEEL FOR SURFACE GRINDER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>[Use of hand tools]<br>Effect of heating and cooling on state of matter. (Change of matter from one form to another)<br>[Resistance to erosion to wheel]<br>Magnetic fields of force<br>[Magnetic tool holding device for dressing]<br>Centrifugal forces developed by bodies in rotation<br>[Broken grinder wheel]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Mechanical to heat energy]<br>[Justification of coolant]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wheel selection] | Measures of length<br>Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.)<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Grit, grade, structure, and bond] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Mounting | Visual analysis, logic, detail inference |
| Touching | Wheel | Tension and movement |



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(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Vise<br>Magnetic chuck<br>Angle plate<br>''C'' clamps<br>Clamps<br>Blocks<br>Shims<br>Studs and nuts<br>Magnetic vee blocks<br>Magnetic parallels<br>Safety glasses | Select work holding device<br>Clean magnetic chuck<br>Install workpiece<br>Turn on magnetic chuck<br>Set to cut<br>Grind<br>Check<br>Finish grind<br>Check | Dirt on chuck<br>Work scrapped<br>Failure to turn on magnetic chuck<br>Scrap work<br>Broken wheel<br>Cuts and bruises<br>Abrasions |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select workholding method | Size and shape of workpiece | Magnetic chuck not turned on<br>Dirt on chuck<br>Improperly held workpiece |

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs, and fixtures]<br>Work input, work output, friction and efficiency in simple machines [Setting time]<br>Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)]<br>Relationship of force to distortion in an elastic body<br>Resistance of materials to change in shape [Proper tightening torque] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Wrench sizes] |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece Mounting | Visual analysis, detail inference, logic, and describing |
| Touching | Workpiece Mounting | Size, shape, tension, and movement |

(TASK STATEMENT) SET STOPS, FEED AND GRIND WORKPIECE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Safety glasses<br>Mics | Set stops to length of stroke required<br>Adjust feed<br>Bring wheel down to work<br>Turn on coolant<br>Engage feed and grind | Flying grit from wheel<br>Eye injury<br>Avoid contact with wheel<br>Cuts and abrasions<br>Workpiece comes loose from holding device<br>Scrap parts<br>Wheel breakage<br>Personal injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine correct feeds | Size, shape, and composition of workpiece | Initial cut excessive<br>Lack of coolant<br>Too heavy feed |

(TASK STATEMENT) SET STOPS, FEED AND GRIND WORKPIECE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Drive mechanisms]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Heat effects workpiece]<br>Centrifugal forces developed by bodies in rotation<br>[Materials fly out]<br>[Workpiece tends to be pulled out of your hand]<br>Effects of friction on work processes and product quality<br>[Overheating will tend to anneal or soften tool bits]<br>Transfer of energy from one form to another<br>[Mechanical energy changes to heat] | Measures of length<br>Addition and subtraction of decimal fractions<br>Measure with the Metric and English system and convert between them |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Scale<br>Gage<br>Workpiece<br>Mounting | Visual analysis, detail inference, logic, and describing |
| Touching | Workpiece<br>Mounting | Size, shape, tension, and movement |



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(TASK STATEMENT) REMOVE AND INSPECT PART FROM SURFACE GUIDER

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>File<br>Inspection instruments<br>Blueprint | Remove part<br>Clean part<br>Deburr part<br>Inspect part | Careless handling of inspection tools<br>Damaged or destroyed tools<br>Burrs on workpiece<br>Cuts |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy | Blueprint<br>Precision gages<br>Micrometers | Inaccuracte inspection equipment<br>Dirty part<br>Burrs on part |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM SURFACE GUIDER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Effects of friction on work processes and product quality<br>[Poor quality due to friction on workpiece or tool] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems |
| Viewing | Workpiece<br>Inspection devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Inspection devices | Size, shape, texture, tension, movement, and temperature |

Duty L Setting Up and Operating Universal Grinder

1 Clean and lubricate universal grinder
2 Select, mount and dress grinding wheel
3 Select and mount work and work holding device
4 Grind workpiece
5 Remove and inspect part from universal grinder

(TASK STATEMENT) CLEAN AND LUBRICATE UNIVERSAL GRINDER

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Oil<br>Grease<br>Oil can<br>Grease gun<br>Rags<br>Solvent<br>Brushes<br>Measuring containers<br>Lubrication charts<br>Abrasive material<br>Wrenches<br>Drop cord | Clean fittings before lubrication<br>Remove and install plug and covers<br>Make necessary adjustments<br>Start and stop machinery | Avoid chips<br>Cuts<br>Do not use pressurized air<br>Eye and machine damage<br>Shut machine off before cleaning<br>Electrical shock<br>Avoid spills<br>Falls<br>Proper disposal of lubricants and solvents<br>Fire<br>Water pollution |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine proper frequency of lubrication<br>Select proper lubricant<br>Locate all lubrication points<br>Determine correct amount of lubricant | Operation manual guidelines<br>Type of machinery | Equipment malfunction |

(TASK STATEMENT) CLEAN AND LUBRICATE UNIVERSAL GRINDER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements<br>[Properties of lubricants]<br>Effects of friction on work processes and product quality<br>[Friction causes deterioration] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Society of Automotive Engineers Specifications]<br>[American Iron and Steel Institute Specifications]<br>Read and interpret charts, tables, and/or graphs<br>[Lubrication charts]<br>Liquid and dry measures<br>[Liquid measure] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operational manuals | Comprehension, trade terminology, description of mechanisms, definition, and instructions |
| Viewing | Equipment | Visual analysis, describing, logic, detail inference, color discrimination |
| Touching | Equipment | Temperature, texture, movement, and tension |

(TASK STATEMENT) SELECT, MOUNT, AND DRESS GRINDING WHEEL

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Grinding wheel<br>Quill<br>Wheel dresser<br>Wrenches<br>Blotters | Select wheel<br>Inspect wheel<br>Clean arbor<br>Install blotters<br>Install washers<br>Tighten nut<br>Install guards<br>Dress wheel | Use of damaged wheel<br>Cuts and abrasions<br>Eye injury<br>Improper dressing procedure<br>Damaged wheel<br>Cuts and abrasions<br>Eye injury<br>Failure to wear eye protection<br>Eye injury<br>Inadequate wheel guards |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select proper wheel<br>Select mounting procedures | Type of grinding performance desired<br>Tension of adaptor flanges | Incorrect wheel selection<br>Improper mounting<br>Guards not installed |

(TASK STATEMENT) SELECT, MOUNT, AND DRESS GRINDING WHEEL

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Using simple machines to gain mechanical advantage<br>[Use of hand tools]<br>Effect of heating and cooling on state of matter<br>(Change of matter from one form to another)<br>[Resistance to **erosion** to wheel]<br>Magnetic fields of force<br>[Magnetic tool holding device for dressing]<br>Centrifugal forces developed by bodies in rotation<br>[Broken grinder wheel]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Mechanical to heat energy]<br>[Justification of coolant]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wheel selection] | Measures of length<br>Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.)<br>[R.P.M.]<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Grit, grade, structure, and bond] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Mounting | Visual analysis, logic, and detail inference |
| Touching | Wheel | Tension and movement |

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORKHOLDING DEVICE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Centers<br>Chuck<br>Drive plate<br>Driving dog<br>Internal grinding holding fixture<br>White lead and oil<br>Wrenches<br>Center rest | Select workholding device<br>Clean part<br>Mount work | Work improperly mounted<br>Scrap parts<br>Cuts and bruises<br>Damaged wheel |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Selection of workholding method | Size and slope of workpiece | Improperly mounted work<br>Stops set incorrectly |

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORKHOLDING DEVICE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advanatage<br>[Clamps, T-bolds, jigs, and fixtures]<br>Work input, work output, friction and efficiency in simple machines<br>[Setting time]<br>Motion resulting from two or more forces acting on a point in a body<br>[Resistance to motion (torque)]<br>Relationship of force to distortion in an elastic body<br>Resistance of materials to change in change in shape<br>[Proper tightening torque] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Wrench sizes] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Mounting | Visual analysis, logic, and detail inference |
| Touching | Workpiece | Tension and movement |

(TASK STATEMENT) GRIND WORKPIECE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workpiece<br>Micrometers O.D. and I.D.<br>Coolant<br>Wrenches<br>Safety glasses | Set stops to length of stroke required<br>Adjust feed<br>Bring wheel into workpiece<br>Turn on coolant<br>Engage feed and grind | Flying grit from wheel<br>Eye injury<br>Avoid contact with wheel<br>Cuts and abrasions<br>Workpiece comes loose from holding device<br>Scrap parts<br>Wheel breakage<br>Personal injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine correct feeds | Size, shape, and composition of workpiece | Initial cut excessive<br>Lack of coolant<br>Too heavy feed |

(TASK STATEMENT) GRIND WORKPIECE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Drive mechanisms]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Heat effects accuracy]<br>Effects of friction on work processes and product quality<br>[Effect of friction on workpiece]<br>Transfer of energy from one form to another<br>[Mechanical to heat energy] | Measures of length<br>Addition and subtraction of decimal fractions<br>Measure with the Metric and English system and convert between them<br>Use of trigonometric functions in solution of problems involving right triangles |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM UNIVERSAL GRINDER

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Wrenches<br>I.D. mics<br>O.D. mics<br>Safety glasses<br>Blueprint | Remove part<br>Deburr part<br>Inspect part | Burrs on workpiece<br>Cuts<br>Handle tools and materials properly<br>Cuts and burns<br>Material damage |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy required | Scale<br>Blueprint<br>Micrometer<br>Gage | Dirt or grit on part<br>Burrs on part<br>Incorrect tolerances |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM UNIVERSAL GRINDER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Effects of friction on work processes and product quality<br>[Poor quality due to friction on workpiece or tool] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)<br>[Plug and ring gage-Sine bar] |

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COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems |
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |



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Duty M Setting Up and Operating Tool and Cutter Grinder

1 Clean and lubricate tool and cutter grinder
2 Select, mount and dress grinding wheel
3 Select and mount tool or cutter holding device
4 Grind tool or cutter
5 Remove and inspect tool or cutter

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(TASK STATEMENT) CLEAN AND LUBRICATE TOOL AND CUTTER GRINDER

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Oil<br>Grease<br>Oil can<br>Grease gun<br>Rags<br>Solvent<br>Brushes<br>Measuring containers<br>Lubrication charts<br>Abrasive materials<br>Wrenches<br>Drop cord | Clean fittings before lubrication<br>Remove and install plug and covers<br>Make necessary adjustments<br>Start and stop machinery | Avoid chips<br>Cuts<br>Do not use pressurized air<br>Eye and machine damage<br>Shut machine off before cleaning<br>Electrical shock<br>Avoid spills<br>Falls<br>Proper disposal of lubricants and solvents<br>Fire<br>Water pollution |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine proper frequency of lubrication<br>Select proper lubricant<br>Locate all lubrication points<br>Determine correct amount of lubricant | Operation manual guidelines<br>Type of machinery | Equipment malfunction |

(TASK STATEMENT) CLEAN AND LUBRICATE TOOL AND CUTTER GRINDER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements<br>[Properties of lubricants]<br>Effects of friction on work processes and product quality<br>[Friction causes deterioration] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Society of Automotive Engineers Specifications]<br>[American Iron and Steel Institute Specifications]<br>Read and interpret charts, tables, and/or graphs<br>[Lubrication charts]<br>Liquid and dry measures<br>[Liquid measure] |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operational manuals | Comprehension, trade terminology, description of mechanisms, definition, and instructions |
| Viewing | Equipment | Visual analysis, describing, logic, detail inference, color discrimination |
| Touching | Equipment | Temperature, texture, movement, and tension |

(TASK STATEMENT) SELECT, MOUNT, AND DRESS GRINDING WHEEL

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Grinding wheel<br>Wheel arbor and nut<br>Wheel dresser<br>Blotters<br>Wrenches | Select wheel<br>Inspect wheel<br>Clean arbor<br>Install blotters<br>Install washers<br>Tighten nut<br>Install guards<br>Dress wheel | Use of damaged wheel<br>Cuts and abrasions<br>Eye injury<br>Improper dressing procedures<br>Damage wheel<br>Cuts and abrasions<br>Eye injury<br>Failure to wear eye protection<br>Eye injury<br>Inadequate wheel guards |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select proper wheel<br>Select mounting procedures | Type of grinding performance desired<br>Tension of adaptor flanges | Incorrect wheel selection<br>Improper mounting<br>Guards not installed |

(TASK STATEMENT) SELECT, MOUNT, AND DRESS GRINDING WHEEL

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>[Use of hand tools]<br>Effect of heating and cooling on state of matter<br>(Change of matter from one form to another)<br>[Resistance to erosion to wheel]<br>Magnetic fields of force<br>[Magnetic tool holding device for dressing]<br>Centrifugal forces developed by bodies in rotation<br>[Broken grinder wheel]<br>Transfer of energy from one form to another<br>Transfer of heat from one body to another<br>[Mechanical to heat energy]<br>[Justification of coolant]<br>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials<br>[Wheel selection] | Measures of length<br>Measure of time and speed (Example: time-seconds, minutes, etc., speed-feet per minute, R.P.M., etc.)<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Grit, grade, structure, and bond] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Wheel<br>Mount set-up | Visual analysis, detail inference, and logic |
| Touching | Install washers<br>Nuts | Size, shape, and tension |



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(TASK STATEMENT) SELECT AND MOUNT TOOL OR CUTTER HOLDING DEVICE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Workhead<br>Centers<br>Toolmakers vise<br>End mill sharpening device<br>Wrenches<br>Stub arbor<br>Mandrel<br>Tooth rest<br>Form cutter holding fixture<br>Indicator and holder | Select cutter holding device<br>Clean holder<br>Mount cutter | Avoid contact with sharp edges of cutter or tools<br>Cuts<br>Handle cutters properly<br>Damaged cutter<br>Cuts and bruises |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select proper mounting devices | Type of tool or cutter | Incorrect selection of holding device<br>Dirty workholding device<br>Tool or cutter mounted loosely |

(TASK STATEMENT) SELECT AND MOUNT TOOL OR CUTTER HOLDING DEVICE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs and fixtures]<br>Work input, work output, friction and efficiency in simple machines [Setting time]<br>Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)]<br>Relationship of force to distortion in an elastic body<br>Resistance of materials to change in shape [Proper tightening torque] | Measures of length |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Mounting | Visual analysis, logic, and detail inference |
| Touching | Mounting | Tension and movement |

(TASK STATEMENT) GRIND TOOL OR CUTTER

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Cutter clearance chart<br>Scale<br>Micrometers<br>Cutter<br>Coolant<br>Wrenches<br>Safety glasses | Set wheel to work<br>Take trial cut<br>Check<br>Grind primary relief<br>Check<br>Grind secondary relief<br>Check | Avoid contact with rotating grinding wheel<br>Cuts and abrasions<br>Avoid flying grit from grinding wheel<br>Eye injury<br>Workpiece comes loose from holding device<br>Broken wheel<br>Cuts and abrasions<br>Eye injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Select relief angles | Cutter clearance chart | Relief angles incorrect<br>Wheel damage<br>Overheating of cutter |

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(TASK STATEMENT) GRIND TOOL OR CUTTER

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Drive mechanisms]<br>Effect of heating and cooling on expansion of materials (Change of dimensions)<br>[Heat effects accuracy]<br>Effects of friction on work processes and product quality<br>[Effect of friction on workpiece]<br>Transfer of energy from one body to another<br>[Mechanical to heat energy] | Measures of length<br>Use of trigonometric functions in solution of problems involving right triangles<br>[Clearance angles] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

(TASK STATEMENT) REMOVE AND INSPECT TOOL OR CUTTER FROM GRINDERS

| TOOLS, EQUIPMENT, MATERIALS OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY -- HAZARD |
|---|---|---|
| Mics<br>Scale<br>Charts<br>Wrenches<br>Surface gage<br>Indicator | Remove cutter<br>Inspect | Handle sharp cutters carefully<br>Damage cutter<br>Cuts |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine properly sharpened tool or cutter | Size, shape, and composition of workpiece | Careless handling of cutter<br>Careless inspection<br>Improper angles on tool or cutter |

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(TASK STATEMENT) REMOVE AND INSPECT TOOL OR CUTTER FROM GRINDERS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Effects of friction on work processes and product quality<br>[Poor quality due to friction on workpiece and tool] | **Measures of length**<br>[Linear measurement]<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Angular measurement]<br>Read and interpret charts, tables, and/or graphs<br>[Clearance angles] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

Duty N Setting Up and Operating Arbor Press

1 Clean and lubricate arbor press
2 Remove and install bearings or bushings
3 Perform broaching operations
4 Remove and inspect part from arbor press

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(TASK STATEMENT) CLEAN AND LUBRICATE ARBOR PRESS



| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Oil<br>Grease<br>Oil can<br>Grease gun<br>Rags<br>Solvent<br>Brushes<br>Measuring containers<br>Lubrication charts<br>Abrasive materials<br>Wrenches<br>Drop cord | Clean fittings before lubrication<br>Remove and install plug and covers<br>Make necessary adjustments<br>Start and stop machinery | Avoid chips<br>Cuts<br>Do not use pressurized air<br>Eye and machine damage<br>Shut machine off before cleaning<br>Electrical shock<br>Avoid spills<br>Falls<br>Proper disposal of lubricants and solvents<br>Fire<br>Water pollution |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine proper frequency of lubrication<br>Select proper lubricant<br>Locate all lubrication points<br>Determine correct amount of lubricant | Operation manual guidelines<br>Type of machinery | Equipment malfunction |

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(TASK STATEMENT) CLEAN AND LUBRICATE ARBOR PRESS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements<br>[Properties of lubricants]<br>Effects of friction on work processes and product quality<br>[Friction causes deterioration] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Society of Automotive Engineers Specifications]<br>[American Iron and Steel Institute Specifications]<br>Read and interpret charts, tables, and/or graphs<br>[Lubrication charts]<br>Liquid and dry measures<br>[Liquid measure] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operational manuals | Comprehension, trade terminology, description of mechanisms, definition, and instructions |
| Viewing | Equipment | Visual analysis, describing, logic, detail inference, and color discrimination |
| Touching | Equipment | Temperature, texture, movement, and tension |

(TASK STATEMENT) REMOVE AND INSTALL BEARINGS OR BUSHINGS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Drift<br>Punch<br>Vee blocks<br>Parallels<br>Plugs<br>Bushings<br>Micrometers<br>Scale | Remove old bearings or bushing<br>Select new bearings or bushings<br>Press fit bearings or bushings<br>Check bearing or bushing for tightness or looseness | Misalignment of bearing or bushing<br>Shearing of seat wall<br>Proper usage of press<br>Eye injury<br>Mashed fingers<br>Workpiece falling on feet<br>It is usually advisable to have another person help when using a press |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine tool used to remove and install bearing or bushing<br>Determine proper bearing or bushing<br>Determine correct fit | Location of replacement<br>Boundary dimensions<br>Reference numbers<br>Sound of equipment | Marr wall surface when removing<br>Bearing or bushing too tight or loose |

(TASK STATEMENT) REMOVE AND INSTALL BEARINGS OR BUSHINGS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Rack and pinion gear on arbor press]<br>[Friction of the press fit]<br>Relationship of force to distortion in an elastic body<br>[Excessive force will damage seat wall]<br>Resistance of materials to change in shape<br>[Compression of bearing or bushings] | Measures of length<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Part numbers] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Bearings and bushings<br>Measuring devices | Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems |
| Touching | Bearings and bushings<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |
| Listening | Operating equipment | Noise discrimination and logic |

(TASK STATEMENT) PERFORM BROACHING OPERATIONS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Broaches<br>Shims<br>Parallels<br>Vee blocks | Select broaching tools<br>(Broach, bushing, and shims)<br>Set-up workpiece<br>Broach workpiece | Care when using broach<br>Cuts from broach<br>Avoid breaking broach<br>Cuts<br>Eye injury |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine proper broach, bushing, and shims to be used | Size and shape of hole/exterior | Applying pressure incorrectly<br>(Hammering arbor press spindle)<br>Poor set-up of workpiece |

(TASK STATEMENT) PERFORM BROACHING OPERATIONS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Broach constitutes simple machines]<br>Relationship of force to distortion in an elastic body<br>Resistance of materials to change in shape<br>[Cutting motion is a distorting factor] | Addition and subtraction of decimal fractions<br>Measures of length<br>Read and interpret charts, tables, and/or graphs<br>[Machinist's Handbook (Keys and Keyways)]<br>Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Broach sizing system] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Set-up<br>Workpiece | Visual analysis, logic, and detail inference |
| Touching | Workpiece | Size and shape |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM ARBOR PRESS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Plug gages<br>Mics<br>Verniers<br>Blueprint<br>Plug gace | Remove part<br>Deburr part<br>Inspect part | Burrs on workpiece<br>Cuts<br>Handle tools and material properly<br>Cuts and burns<br>Material damage |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine degree of accuracy required | Scale<br>Blueprint<br>Micrometer<br>Gage | Dirt or grit on part<br>Burrs on part<br>Incorrect tolerances |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM ARBOR PRESS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Effects of friction on work processes and product quality<br>[Poor quality due to friction on workpiece or tool] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) |

**COMMUNICATIONS**

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems |
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

Duty 0 Setting Up and Operating Electrical Discharge Machine (EDM)

1 Clean and lubricate electrical discharge machine
2 Make electrode
3 Setup (EDM) machine
4 Machine part to drawing specifications
5 Remove and inspect part from EDM

(TASK STATEMENT) CLEAN AND LUBRICATE ELECTRICAL DISCHARGE MACHINE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Oil<br>Grease<br>Oil can<br>Grease gun<br>Rags<br>Solvent<br>Brushes<br>Measuring containers<br>Lubrication charts<br>Abrasive materials<br>Wrenches<br>Drop cord | Clean fittings before lubrication<br>Remove and install plug and covers<br>Make necessary adjustments<br>Start and stop machinery | Avoid chips<br>Cuts<br>Do not use pressurized air<br>Eye and machine damage<br>Shut machine off before cleaning<br>Electrical shock<br>Avoid spills<br>Falls<br>Proper disposal of lubricants and solvents<br>Fire<br>Water pollution |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine proper frequency of lubrication<br>Select proper lubricant<br>Locate all lubrication points<br>Determine correct amount of lubricant | Operation manual guidelines<br>Type of machinery | Equipment malfunction |

(TASK STATEMENT) CLEAN AND LUBRICATE ELECTRICAL DISCHARGE MACHINE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, and elements<br>[Properties of lubricants]<br>Effects of friction on work processes and product quality<br>[Friction causes deterioration] | Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal<br>[Society of Automotive Engineers Specifications]<br>[American Iron and Steel Institute Specifications]<br>Read and interpret charts, tables, and/or graphs<br>[Lubrication charts]<br>Liquid and dry measures<br>[Liquid measure] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Operational manuals | Comprehension, trade terminology, description of mechanisms, definition, and instructions |
| Viewing | Equipment | Visual analysis, describing, logic, detail inference, color discrimination |
| Touching | Equipment | Temperature, texture, movement, and tension |

(TASK STATEMENT) MAKE ELECTRODE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Electrode materials<br>Machining equipment<br>Wrenches<br>Safety glasses<br>Micrometers | Select electrode materials<br>Machine electrode to exact print specifications<br>Inspect the electrode | Improper use of equipment<br>Cuts and abrasions<br>Eye injury<br>Burns |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine electrode materials<br>Determine number of electrodes to make (roughing and finishing) | Electrical conductivity<br>Machinability<br>Resistance to deformation during erosion process<br>Low tool wear rates | Rough finish on electrode |

(TASK STATEMENT) MAKE ELECTRODE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Resistance of materials to change in shape<br>[Electrodes made from soft materials]<br>Composition of matter, including protons, neutrons, electrons, atoms, molecules, and elements<br>[Composition of electrode materials]<br>Resistance of materials to flow of electrical current | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems |
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |

(TASK STATEMENT) SETUP ELECTRICAL DISCHARGE MACHINE

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY -- HAZARD |
|---|---|---|
| Feed controls<br>Feed charts<br>Electrode holder (collets) | Mount electrode<br>Select and mount work and holding device<br>Select and set feed rate<br>Check dielectric fluid | Proper feed rate<br>Excessive electrode wear |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine type of holding device<br>Determine feed rate<br>Determine type of dielectric fluid | Electrical conductivity<br>Gap between electrode and workpiece<br>Vaporizing qualities | Poor mounting of work<br>Improper dielectric fluid<br>Damaged electrode |

(TASK STATEMENT) SETUP ELECTRICAL DISCHARGE MACHINE

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Specific gravity of dielectric]<br>[Tools to mount workpiece] | Measure of time and speed (Example: time-seconds, minutes, etc., speed-feet per minute, R.P.M., etc.)<br>[Speed] |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Feed charts | Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems |
| Viewing | Set-up | Visual analysis, logic, and detail inference |

(TASK STATEMENT) MACHINE PART TO DRAWING SPECIFICATIONS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY - HAZARD |
|---|---|---|
| Workpiece<br>Micromters<br>Blueprint<br>Wrenches<br>Holding fixtures<br>Dielectric fluid | Start machine and feed machine mechanisms<br>Check circulation of dielectric fluids<br>Change electrodes when needed | Oil splashing<br>Slips or falls<br>Oil splashing in eye |
| **DECISIONS** | **CUES** | **ERRORS** |
| Determine when to change electrode<br>Determine pressure of dielectric fluid<br>Determine efficiency of electrode | Average wear ratio of workpiece to electrode<br>Point of machining process (beginning or optimum cutting)<br>Metal removal rates | Rough finish<br>Short circuit |

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(TASK STATEMENT) MACHINE PART TO DRAWING SPECIFICATIONS

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Transfer of energy from one form to another [Transfer electrical to heat energy]<br>Transfer of heat from one body to another [Heat absorbed by dielectric]<br>Resistance of materials to flow of electrical current | Measures of length<br>Addition and subtraction of decimal fractions<br>Measure with the Metric and English system and convert between them<br>Use of trigonometric functions in solution of problems involving right triangles |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Feed charts | Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems |
| Viewing | Set-up | Visual analysis, logic, and detail inference |

(TASK STATEMENT) REMOVE AND INSPECT PART FROM EDM

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Blueprint<br>Workpiece<br>Scale<br>Mics | Remove part<br>Deburr part<br>Inspect part | Burrs on workpiece<br>Cuts<br>Handle tools and materials properly<br>Cuts and burns<br>Material damage |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine degree of accuracy required | Scale<br>Blueprint<br>Micrometer<br>Gage | Dirt or grit on part<br>Burrs on part<br>Incorrect tolerances |

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(TASK STATEMENT) REMOVE AND INSPECT PART FROM EDM

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| Simple machines used to gain mechanical advantage<br>Work input, work output, friction and efficiency in simple machines<br>[Tools to remove workpiece] | Measures of length<br>Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) |

COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Blueprint | Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems |
| Viewing | Workpiece<br>Measuring devices | Visual analysis, detail inference, logic, recognize symbols, codes, and emblems |
| Touching | Workpiece<br>Measuring devices | Size, shape, temperature, texture, tension, and movement |